ELECTRICAL REVIEW

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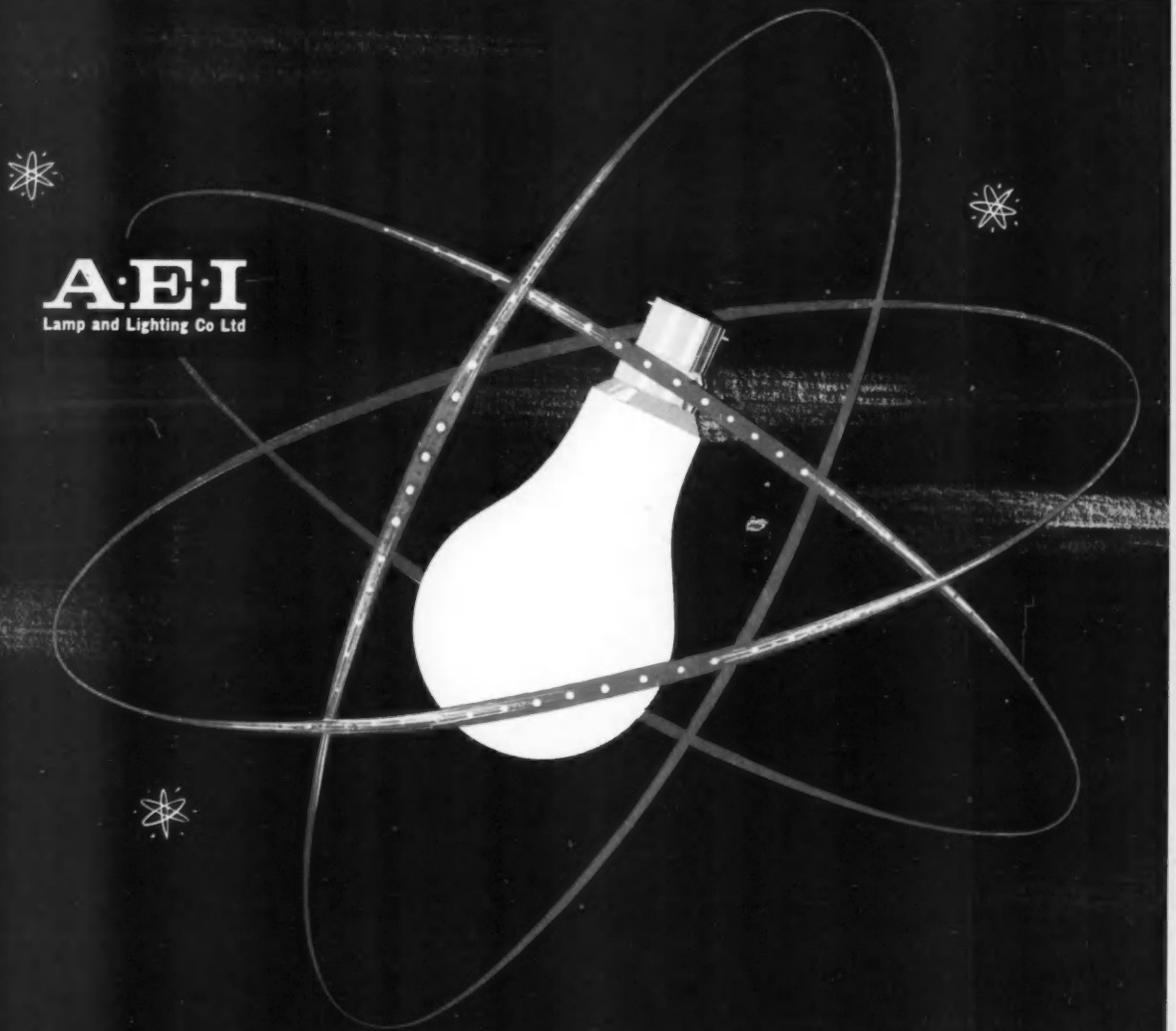

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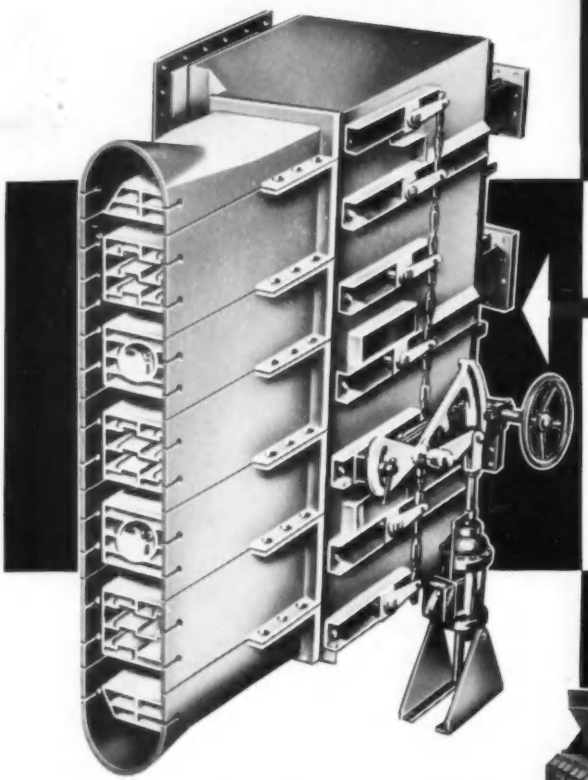

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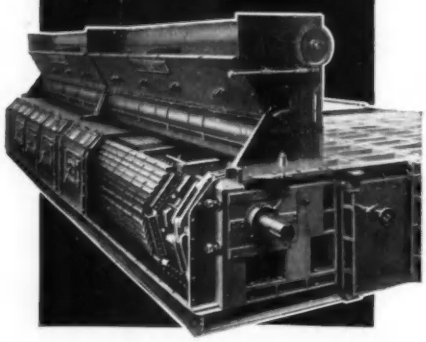

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ELECTRICAL REVIEW

6 February 1959 Vol. 164 No. 6 Established 1872

Power Progress in Canada

AN epoch-making event will take place in Canada this summer when the Queen inaugurates the ambitious St. Lawrence Seaway project. With this is associated the equally impressive hydro-electric development carried out jointly with the United States along the International Rapids Section of the St. Lawrence River. When completed at the end of this year the adjoining Canadian and United States power houses will have a combined capacity of 1,640 MW. Their overall length is 3,300ft and maximum height 162ft.

Although the conception of the scheme dates back something like half a century, actual construction on this huge undertaking did not start until August, 1954, and has since been carried out at a record-breaking speed. These two characteristics of size and speed, usually associated with the American way of life, can in fact equally be applied to the Canadian outlook and the need for recognition of the latter aspect among British exporters has been a recurring theme of the several trade missions that have visited this country in the last year or two.

In the matter of size, the latest report issued by the Department of Northern Affairs and National Resources shows that the St. Lawrence scheme is only one of a number of large-scale power developments either in hand or projected in Canada and in several of which British manufacturers have secured a share. Last year no less than 2,485,000 h.p. of new hydro-electric capacity was brought into service—more than in any previous year in the country's history. The extent of this achievement may be measured by comparison with the record plant installation figure for Great Britain of 2,100 MW in 1956; and Canada, of course, has a population only a third the size of our own. New developments or additions to existing plants at present under construction are expected to add about 2,000,000 h.p. this year and more than 2,600,000 h.p. over succeeding years. Looking farther ahead, one of the largest projects in contemplation is that on the Peace River in British Columbia, where surveys carried out by the British Thomson-Houston Co. for the Wenner Gren B.C. Development Co. have indicated that a power potential of some 8,000,000 h.p. exists.

Apart from hydro-electric schemes, increasing attention is being paid

to thermal generation. In Ontario, for example, where the *per capita* consumption of electricity is higher than that of the United States, the position has been reached where new hydraulic developments are now exceeded by plans for thermal-electric generating facilities. The capacity of the Richard L. Hearn station in Toronto is being trebled to 1,200 MW and two 300 MW turbo-generators have been ordered from C. A. Parsons & Co. for the new Lakeview station west of the city. Plans are also being made for a 200 MW nuclear station and notable progress is reported in the field of transmission, including an experimental line in Ontario to operate at 600 kV.

From the point of view of British participation, it is encouraging to observe that while there was an overall fall in our exports last year, Canadian purchases rose from £12·8 million to £13·6 million. There is, however, clearly scope for a substantial increase in this figure, which represents only a comparatively small proportion of Canada's total electrical imports (£103·8 million in 1957).

BRITISH BIDS FOR AMERICAN CONTRACTS

Undaunted by the turning-down of its tender for the Greer's Dam turbines, the English Electric Co., Ltd., has made an offer to supply three turbines, at a price of £1·9 million, for the Snake River (Washington) development. The tender is said to be well below the lowest American bid—that of the General Electric —but not low enough to escape the mesh of the Buy American Act.

In the meantime discussion of the Greer's Dam affair has gone on. Mr. Dulles was brought into it and strongly refuted the suggestion that the decision to reject the English Electric offer was a political move. He said that it was vital to keep certain types of American equipment "alive" in the interests of national security. This was contested by the *Wall Street Journal,* who put the decision down to "Pennsylvania politics." It was implied that American efficiency would be improved by encouraging foreign competition and that the decision would not strengthen national security. Moreover the American public would have to pay about $300,000 more than was necessary for the turbines. Similar opinions were voiced by a group of Democratic members of Congress last week.

PASSENGER LIFT CONTROL

With the conventional form of Ward-Leonard control of lifts it is not possible to obtain constant acceleration and retardation and thus secure a higher average speed. The article on the next page describes an electronic control system applied to the field of the Ward-Leonard generator. Because of the increased speed and efficiency achieved by a system fitted with this control scheme, the number of lifts in a multiple bank can be reduced. The efficiency is, however, dependent on the normal mode of operation of the lifts; it is at the optimum when the average journeys are between more than two floors when a high "running" speed is obtained before retardation.

A type of lift system that does not depend on rates of acceleration is again coming into favour. It was 40 or 50 years ago that this, the continuous, type was first installed but it is only in the last five years that it has again been employed in a number of large buildings. The lift cars do not stop at floors but move continuously at a speed of 60–75 ft/min. They have, however, been installed only in office blocks where the passengers have been "trained" to use them.

PURCHASE TAX CHANGES

There are again indications that uncertainty about possible purchase tax alterations in April is putting the brake on the sales of some domestic appliances. Every year, a month or two before Budget Day, this phenomenon occurs, leading to unevenness in a production curve already affected by seasonal influences.

Rather optimistically it has been suggested that the Chancellor of the Exchequer should declare his intentions in advance of the Budget. This is against all tradition and hardly likely to be accepted by any Chancellor.

There is no need for purchase tax alterations to be included in the Budget proposals. The tax is variable by the Customs and Excise authorities at any time of the year and there have been many instances of such practice. What needs to be avoided is a fixed time for the announcement of changes, for this may lead to the deferment and piling-up of demand.

AIRCRAFT ELECTRICAL SYSTEM

The component parts of the main electrical power system installed in the Vickers-Armstrongs' Vanguard passenger aircraft, which is described in this issue (page 248), have been designed and built to specifications prepared by the company and put out to tender to the various equipment manufacturers concerned. This, a departure from the normal practice, has resulted in a composite system with each item selected on technical merit, and it is confidently expected that an extremely high degree of serviceability and operational performance will be achieved. Ease of maintenance has been carefully considered at each of the various design stages and development engineers from the airlines who will operate the aircraft have been constantly consulted on this aspect. A highly acceptable installation has been obtained by these means, assisted by the fuselage configuration employed which gives a large volume for the equipment bays. As an example of the attention given to the maintenance problem, wiring diagrams, presented in accordance with A.T.A. Specification 100, have been drawn in a manner to prevent the appearance in the wiring diagram manual of data required solely for production purposes.

Electrical integrity is obviously of paramount importance in an aircraft installation and two emergency systems have been provided, the first of which has a secondary busbar system for use if a fault occurs on the main busbar system, while the second employs the battery to sustain essential loads. The electrical and mechanical protection given to the system renders a busbar fault extremely unlikely, and it is considered that a total electrical failure necessitating the use of the battery could occur only if all four engines failed, which is an extremely remote possibility.

Speed Control of Lifts

ELECTRONIC SYSTEM FOR A CONSTANT RATE OF ACCELERATION

Passenger comfort in a lift depends on the smoothness of the rate of acceleration. If this rate can be made constant, it is possible to obtain a higher average speed for a passenger lift. An electronic control system to give a constant rate of acceleration is described

By D. M. C. DICK
AND
D. EMBREY*

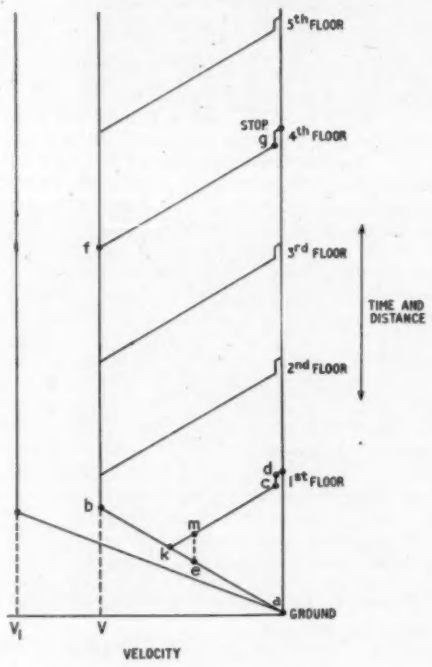
THE post-war increase in the number of multi-storey flats, offices and departmental stores has aroused a great amount of technical interest in the control of passenger lifts which has resulted in an attempt to improve the comfort of the passenger and, at the same time, decrease the time in the car travelling between floors. The first essential in a well-designed passenger lift is the comfort of the passenger in the car. It is the control of acceleration and retardation which determines the sensations experienced by passengers.

The drive generally takes one of five forms:—(a) single-speed motor; (b) two-speed a.c. motor; (c) Ward Leonard variable-voltage system with a geared machine; (d) Ward Leonard variable-voltage system with a gearless machine; (e) Ward Leonard equipment with geared or gearless machines combined with electronic speed control.

(a) A single-speed motor has many disadvantages as the top speed of the installation is limited because of the difficulty of obtaining accurate levelling above speeds of approximately 100 ft/min.

(b) A two-speed a.c. motor also has limitations with regard to speed as the normal maximum speed reduction which can be obtained is approximately 6 to 1. A further limitation is the comparatively low value of the maximum number of starts per hour which can be obtained without overheating.

Fig. 1.—Velocity/time diagram



(c) The conventional form of Ward Leonard equipment, which is controlled by the natural build-up of the generator field in association with series fields carrying the motor armature current, is normally used for speeds between 150 ft/min and 300 ft/min using the geared machine. It is, however, not feasible to obtain constant acceleration and retardation characteristics under all conditions of load. The result is that the time taken going between floors can vary considerably with the load in the car so that the system is not as efficient as might be expected.

(d) When the conventional Ward Leonard equipment is used in conjunction with a gearless machine the same characteristics apply in regard to speed variation with load.

(e) The system described below is a Ward Leonard system controlled rigidly by a series of external signals supplied after suitable modification to the field of the generator. The lift motor is thus made to perform in exactly the same manner irrespective of load, direction, distance of travel or within reasonable limits of supply voltage, this form of control being used on geared or gearless machines.

It will be appreciated that if it is possible to obtain constant acceleration and retardation rates then these rates can be increased, with no discomfort to the passenger, well above those which it is possible to obtain with the conventional field control. It is therefore possible to travel through a specific distance with a considerably higher average speed with this rigidly controlled equipment than is possible with the conventional form of control and from this it follows, that with the increased efficiency of the installation, it is possible to reduce the number of lifts necessary in a multiple bank. Therefore, there will be a considerable saving in initial capital expenditure, a reduction in maintenance costs over the years, together with a larger working floor area available in the building; the last is a most important factor in view of today's high cost of rental per square foot area.

Control Characteristics

If the speed/distance function is plotted for a multi-storied building it will look like the diagram depicted in Fig. 1. If the car starts from the ground floor, en route for the fourth floor, it moves from (a) and accelerates to a velocity (V) at (b); it then continues at a constant speed

* Mr. Dick is a director of A. & P. Steven, Ltd., and Mr. Embrey is with the Electric Construction Co., Ltd.

until point (f) is reached when the car retards to point (g) which is the levelling speed. When the car approaches the correct level it retards to stop and the brake is applied.

If the car is running from one floor to the next, then one of two ways may be traced along the speed/direction curve. The car may accelerate to point (k) and then go straight into retardation and then to (c), (d) and finally stop, or a lower running speed may be selected. The car will start at point (a) and accelerate to point (e). It will then assume the lower running speed and continue at this speed until point (m) is reached. It will then retard to (c) where it will level until point (d) is reached when it will decelerate to a stop.

If a higher running speed (V1) is required, a higher rate of acceleration will also be required if the car is to get to running speed at the same position relative to the lift shaft. If the original rate of acceleration is employed, then, when the car is used for travelling between two floors only, it never really gets to the higher running speed before it has to retard. To avoid passenger discomfort a lower speed can be used for moving between adjacent floors, but this defeats the object of a higher running speed.

Faster rates of acceleration will not be uncomfortable to the passenger if the acceleration characteristic is carefully controlled and if this control is maintained irrespective of load, direction of travel, etc.

Electronic Control System

In the electronic control system the accelerate/retard characteristic is produced by a reference voltage generator. This function generator produces a voltage which rises with respect to time in the same manner as the car speed should do.

One of the many ways of producing such a voltage consists of charging a capacitor through a resistance, but the function so produced is an exponential voltage curve. This, if used to control a lift, would produce a most unpleasant sensation at the start of the acceleration period unless the overall period was long. To reduce this sensation some method must be used to linearise the potential build-up across the capacitor.

One of the simplest ways to do this is to charge the capacitor through a constant-current pentode. This method utilises the fact that the anode current in the pentode is reasonably independent of the applied anode potential, but is dependent upon the screen potential. In this way the slope of the potential across the capacitor

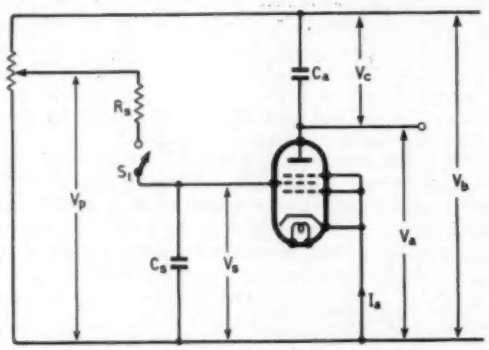


Fig. 2.—Reference voltage generator circuit

Rs = Screen time constant resistor
Cs = Screen time constant capacitor
Ca = Control function time constant capacitor
Va = Anode voltage
Vb = Supply voltage
Vc = Potential of control function
Vp = Final screen potential
Vs = Screen potential at any time

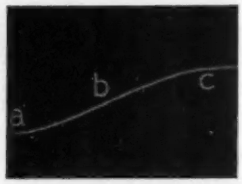


Fig. 3.—Oscillogram of reference source

is proportional, instantaneously, to the value of the charging current. If, then, the variations in the charging current are reduced, the slope of the characteristic becomes more constant.

By suitable choice of pentodes it is possible now to obtain this constant current characteristic down to anode potentials as low as 5 V. It can be shown that the time taken to accelerate to running speed is approximately $T = Ca \cdot Ra$, where Ca is the reference capacitor in farads, Fig. 2, and Ra is the average anode impedance in ohms over the range of anode potential swing during the charge. The value of Ra is made variable by changing the screen potential; thus the time taken to accelerate to running speed is approximately proportional to the applied screen potential.

The important feature of the circuit is the shape of the velocity/time curve at the start and finish. This appears in Fig. 3 and is an oscillogram of the actual voltage produced by the function generator. The curvature at (a) is due to the slow screen build-up, whilst the curvature at (c) is the effect of the anode voltage, Va, running below the value for linear operation. The constant current portion is shown at (b). This curvature at top and bottom produces a very gentle start and a smooth run into final speed. The other oscillogram in Fig. 4 shows the relation between car speed and time.

The discharge of the reference capacitor can also be linearised in the same way by causing the discharge current to flow into a constant-current pentode, the time again being determined by screen potential. In this case, however, the discharge is not allowed to become complete and the capacitor runs down to a potential which is made proportional to the levelling speed of the car.

Application of the Control Function

Having now produced a reference voltage to control the servo, some form of feedback must be taken. In this case the feedback is generated by a tachometer generator. Special attention must be paid to the tachometer generator output. A reasonably large output voltage is convenient, but the percentage ripple must be low if smooth control is to be obtained over the whole range of the accelerate/retard characteristic. Large ripples occurring at the low speed associated with the levelling condition require filters with long time constants and this is undesirable because it introduces stability problems at the higher running speeds. In practice it is found that the ripple should not be much greater than about two per cent. Linearity of the voltage/speed characteristics is important.

The coupling of the generator to the lift motor calls for some care and consideration. Ideally, the generator should be directly coupled to the lift motor shaft, but this presents many problems. The lift motor is fitted with journal bearings whilst the tachometer generator is fitted with ball bearings and the motor thrust must not be taken on the small generator bearings. Alignment also is more difficult, and while this presents little difficulty in the factory, it can be most inconvenient if a generator has to be changed on site.

In practice, therefore, a flexible coupling is adopted,

but if this is made too flexible stability problems arise. This is due in part to the generator armature swinging relatively to the motor shaft at certain speeds. The coupling chosen must have very little angular play but must still be able to allow axial float of the motor shaft, Fig. 5.

Having now produced a voltage by adding the reference voltage in opposition to the tachometer voltage, which represents the departure of motor speed from the speed dictated by the reference signal, it is necessary to convert the error voltage into an error current. This is done quite simply by applying the voltage to the grid of a valve which has a known mutual conductance, that is the change in anode current for a given change in control grid potential. A pentode is again used in this circuit because it affords a reasonable mutual conductance and has a very high anode impedance. It is this latter factor which is the more important. A current is now produced which varies in sympathy with the error signal and this may be used in a number of ways depending upon the way the current into the field of the generator is controlled. This last stage is simply a power amplifier and it may consist of one of the various forms of magnetic amplifier or a system of grid controlled thyratrons. There are other methods, but they generally apply to power amplifiers having a lower output power than is required here.

A pair of grid controlled thyratrons are used to supply the field in this case and the grids are controlled by a voltage which can be varied in phase relatively to the anode. This phase-shifted voltage can be produced in a bridge circuit, one arm of which is a small saturable reactor. The d.c. windings of this reactor are placed in series with the anode of the amplifier pentode, the high value of the pentode Ra being used to minimise the circulation of second harmonic currents. Thus the inductance in the phase-shift bridge varies in proportion to the error signal and the degree of phase shift varies accordingly, Fig. 6. A negative bias is produced at the

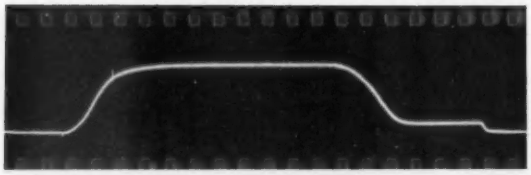


Fig. 4.—Oscillogram of lift car acceleration and retardation to levelling speed and finally to stop

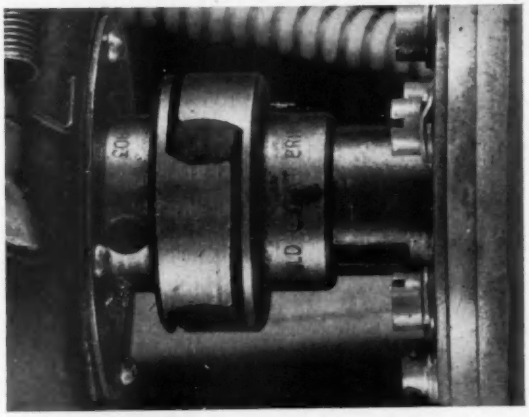


Fig. 5.— Coupling showing axial movement with little radial compliance

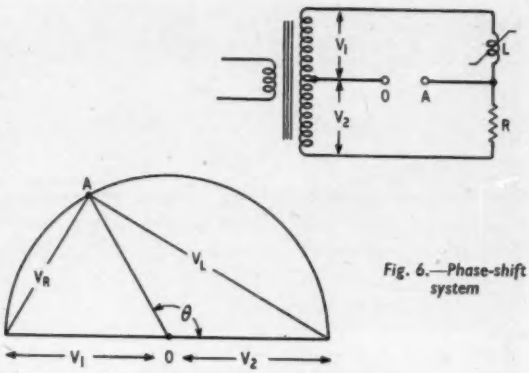


Fig. 6.—Phase-shift system

grids of the thyratrons by the grid current flowing through the grid stopper and stored by the grid capacitor. This system of bias produces a negative voltage which varies in amplitude as the phase-shifted voltage and so is somewhat independent of supply voltage variations.

A current, flowing in the field of the generator, has now been produced, varying as the error signal and it only remains for the armature of the lift motor to be connected in parallel with the armature of the generator for the servo loop to be complete.

This loop, however, has several different time constants and stable operation can be obtained only by the addition of negative feedback introduced at the input to the amplifier. If this feedback was present under all conditions a loss in gain would result and the control would not be so tight as may be expected. To overcome this, a feedback is applied which is proportional to the rate of change of generator output voltage. This can be done in one of two ways: by a resistance-capacitance network or by a transformer. In the case of the resistance-capacity network, the voltage across the resistance is equal to $R\frac{d^2i}{dt^2}$ while in the case of the transformer the voltage is equal to $-L\frac{di}{dt}$ and it will be seen that both these voltages are produced as the result of the rate of change of current; in this case the current in the armature of the lift motor.

Advantages of Closed Loop Control

The outstanding advantage of electronic control is the ease with which the required characteristic may be set up. The equipment has a number of independent pre-set controls which affect the levelling speed, the acceleration, retardation and the running speed. By adjustment of these controls almost any combination of the conditions may be set and the conditions will be reproduced irrespective of load or direction of travel.

This form of control can produce acceleration and retardation characteristics so smooth that no sensation of movement can be felt in the lift car. The acceleration and the deceleration time can be varied from 0·5 sec to a maximum of 6 sec. The lift motor has a maximum speed of 1,000 r.p.m. and can be controlled down to a levelling speed of 30 r.p.m.

E.W.F. DINNER

Mr. Peter Thorneycroft, M.P., is to be the principal speaker at the annual dinner of the Electrical Wholesalers' Federation at the Dorchester Hotel, London, W.1, on 19th March (6.30 for 7 p.m.).

"Vanguard" Electrical Power System

Variable Frequency Generation Rectified for D.C. Utilisation

Six variable speed engine driven alternators with a total capacity of 300 kVA supply the electrical power requirements of the latest British passenger aircraft. Variable frequency a.c. is used for windscreen, power plant and tail unit de-icing and silicon rectifiers provide a 28 V d.c. supply for other aircraft services

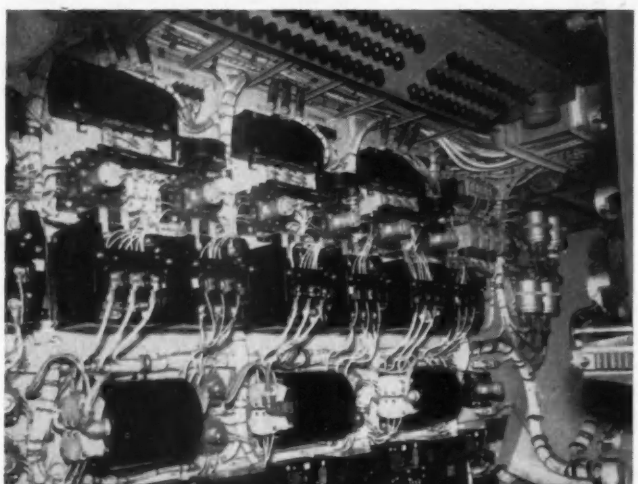
THE latest civil aircraft to be produced by Vickers Armstrongs (Aircraft), Ltd., of Weybridge, Surrey, the "Vanguard," can carry up to 139 passengers and 10 tons of freight at cruising speeds in excess of 420 m.p.h. A 28 V d.c. system supplied through transformer/rectifier units from variable frequency generators has been installed, enabling available airborne components and airline operators' existing ground servicing equipment to be used. Large capacity generators to supply the power plant and tail unit de-icing in addition to the d.c. system are fitted, electrical de-icing of these units being chosen since air bleeding seriously affects engine performance. Constant frequency loads are supplied from the d.c. bars through rotary invertors. The 300 kVA installed capacity, one of the largest airborne installations in the world, includes a reserve to meet future development of the aircraft services.

Generating Equipment

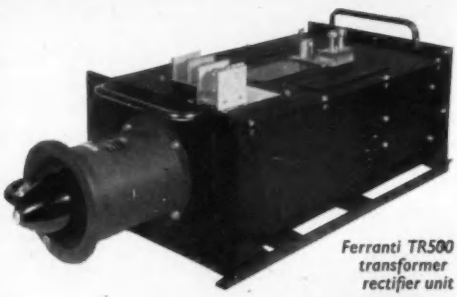
Four variable speed, three-phase Rotax alternators, rated at 50 kVA, 208 V, are driven from the 5,315 equivalent shaft horse-power Rolls Royce "Tyne" propeller turbine engines; each supplies up to 28 kVA for the associated propeller, spinner and engine intake de-icing and 5 kVA for galley and domestic heating loads in addition to its transformer/rectifier unit. A shunt wound exciter is incorporated in these machines, having two separate field windings, one in series with the voltage regulator carbon pile and fed from a small rectifier supplied by the alternator output, the other supplied by rectifiers connected to current transformers sensing the alternator output line current. Two similar alternators, one on standby duty, supply the Triplex "Gold Film" windscreen glass and Napier "Spray Mat" tail unit de-icing systems, switching being provided to ensure equal utilisation.

The main busbars are supplied through four 500 A, 28 V d.c. Ferranti silicon transformer/rectifier units. Each has a double-wound transformer with a delta connected primary and two star connected secondary windings joined through an interphase transformer, centre-tapped to provide the positive output connection. Six silicon diodes of 30 A nominal rating are connected in parallel to each limb of the secondary winding, with a common connection to the heat sink which, at negative polarity, forms an earth connection of the d.c. network. Cooling is effected by an a.c. Plannair axial flow blower.

The main d.c. loads fed from the 28 V busbar include



Part of the electrical equipment bay

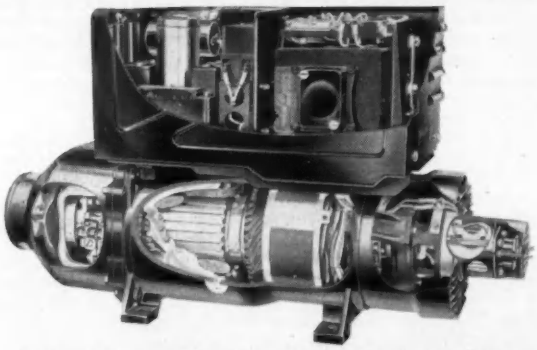


Ferranti TR500 transformer rectifier unit

Rotax 50 kVA engine-driven three-phase alternator

170 A for the 9in Plannair cabin air recirculating blower, 130 A for 23 food heaters in the galley and 145 A for radio and similar services. Passenger cabin lighting requires up to 62 A with an additional 30 A for individual lights, and the total landing and taxi-ing lighting demand is 72 A. The Lucas fuel pumps draw 18 A, doubled during take-off and landing, and some 72 A is taken by the toilet water heaters.

The largest single load, 237 A, is imposed by the 3 kVA Plessey rotary invertors supplying equipment operating at constant frequency. These three machines, one of which is on standby duty, provide a three-phase, 200 V, 400 c/s output at any power factor between 0·8 lagging and 0·95 leading. The output voltage and frequency of these invertors, which can operate at full load in ambient temperatures between −30 deg C and +45 deg C, is maintained within ±3 per cent by two control circuits, the voltage by a carbon pile regulator with a compounding transformer, and the frequency by a centrifugal carbon pile governor. The shunt-wound motor incorporates speed control windings, and a swamp resistance is connected in series with the field winding to compensate for large ambient temperature variations. A single 450 VA Plessey invertor, connected to the battery



The control box housing the starting gear, radio interference suppression components and voltage regulator is mounted integrally with the Plessey 3 kVA invertor

busbar, provides an emergency supply for the radio in the event of a total engine, and main electrical power, failure.

Six 24 V, 25 Ah Peto & Radford " Dagenite " batteries are installed to provide an emergency power source and for engine starting duty, though ground starting trolleys are normally used if available. The battery can sustain essential loads during the aircraft's maximum glide time. Each engine is equipped with a Rotax electric starter driving the turbine high-pressure spool through gearing. The starters have a 60 sec rating of 17·2 h.p.

A 20 kW, 28 V d.c. resistance heater is fitted in those aircraft being supplied to Trans-Canada Airlines, employed in conjunction with the recirculating blower for cabin heating on the ground when supplied through a separate ground connector. Each engine drives a Rotol alternator generating 19 V three-phase to serve the propeller synchronising and synchrophasing system.

The basic system protection includes Merz Price a.c. feeder protection and a.c. over-voltage relays, both tripping the alternators, and indication of earth leakage and a.c. under-voltage is given. The transformer/rectifier unit contactors can be tripped by a.c. current balance relays, d.c. overvoltage relays, unit overheat protection relays and d.c. reverse current circuit-breakers. In addition, the alternators are provided with voltage and frequency controls, and the transformer/rectifier units with load sharing and limiting controls. Indication is given of failure of the cyclic switch controlling certain de-icing loads.

If a fault develops on the main d.c. busbar the transformer/rectifier units can be switched to a separate emergency busbar, with the battery. The battery back-up capacity available has not been employed to supply aircraft loads, though it is used to provide large fault currents for tripping protective devices.

Cabin Lighting

Fluorescent lighting has been provided in the passenger cabin, and to prevent the invertors being run for long periods with the airrcaft on the ground a transistorised static invertor has been developed in conjunction with the General Electric Co., Ltd. Approximately half of the tubes are supplied from these individual invertors, providing an adequate illumination level for cleaning, maintenance and passenger loading, the remainder being operated in flight directly from the main invertors. In addition to a 1,000 A socket enabling a ground supply to be fed directly to the 28 V d.c. busbar, ground/flight adaptors have been developed enabling ground rig alternators to be connected, replacing the aircraft's alternators, for testing and calibrating the complete system without running the main engines. These adaptors, connected in each alternator feeder, incorporate three sets of heavy duty and eight sets of light duty contacts for the feeder lines, and control, excitation and protection circuits. An eleven-way link assembly is inserted to bridge the sets of contacts in the " in-flight " condition, connecting the aircraft alternators to the supply system.

The main electrical equipment bay, housing the transformer/rectifier units, rotary invertors, batteries and the control, protection and distribution equipment for the system, is situated beneath the main cabin floor approximately half-way along the fuselage. Access for mainten-

ance and servicing is provided through a hatch in the bottom of the fuselage, or, in flight, through a hatch in the passenger cabin floor. Glass fibre cable ducts and panels have been fitted, and moulded high-temperature nylon terminal blocks specially developed. B.I.C.C. "Nyvin," "Nyvinal" and "Tersilal" cables have been used throughout, with the exception of thermocouple extension leads, flexible cable for Class II circuit wiring and miniature instrument cables.

Constant frequency loads supplied by the invertors include h.f. and v.h.f. radio connection equipment, navigation equipment and radio altimeter, together with the weather radar, automatic direction finding system and passenger address system. The radio equipment racks are situated immediately aft of the flight deck, and the weather radar in the aircraft nose can be fitted with a 28in dish scanner. The majority of the radio aerials will be flush mounted.

Electrical Engineers' Exhibition

AN electric clock, claimed to be the largest in the world, will be one of the exhibits of more than usual interest to be seen at the Electrical Engineers' Exhibition which opens at Earls Court, London, on 17th March. The clock, from the Synchronome Co., Ltd., will be suspended from the roof of the main hall and will be controlled by a standard Synchronome master clock which will be on the company's stand. It will be 6oft in diameter and the tip of the minute hand will therefore travel just over 18in for each half-minute impulse from the master clock. The movement is electrically wound once an hour and the total electricity consumption of the clock for one day is less than ½ kWh.

On the Synchronome stand visitors will also be able to see a "Shortt" free pendulum clock, similar to those installed in most observatories in the world and in such institutions as the American Bureau of Standards in Washington and the National Physical Laboratory at Teddington.

Special attention at the exhibition will be focused on the use of lighting in shop window displays. Approximately 5,000 sq ft on the first floor of Earls Court will be devoted to demonstrating the country's latest display lighting techniques, with the accent on the correct use of lighting rather than on increased lighting.

The special lighting feature will be staged in the shape of a covered arcade of shops and some 160 sq ft of display window frontage will be used. Windows will run along both sides of the arcade and in the centre there will be a bank of grass, paved verges and two modern street lighting columns. At the entrance a colour and jet changing fountain will be featured by the British Thomson-Houston Co., Ltd.

Manufacturers of various items of equipment and products will be co-operating with stores and important retail shops to assist the ten lighting firms who will each be presenting one completely dressed and fitted window. In addition to the latest methods of lighting, therefore, the newest display equipment will also be used.

Underground Gasification Tests to End

AS indicated by Lord Mills in the recent debate on the Government's fuel and power policy in the House of Lords (*Electrical Review*, 30th January, page 226), it is not now proposed to proceed with the underground gasification experiments at Newman Spinney, near Chesterfield, to provide a full-scale plant.

The National Coal Board announced last week that small quantities of gas have been used in the Central Electricity Generating Board's temporary pilot power station at the site and within the next few weeks it is hoped that the full production of this station will be achieved from gas provided by two different systems of gasification. One system was designed as a result of experiments carried out by the Ministry of Power and the National Coal Board, and the other is based on Russian experience suitably adapted for conditions in this country and evolved as a result of exchanges of visits between experts from both countries. The intention in the British experiments was to produce gas from seams which would not otherwise have been mined. Sufficient results have been obtained to lead the Coal Board to the view that the commercial prospects of underground gasification, as far as the fuel needs of this country are concerned, do not justify further expenditure when it is clear that considerable development work remains to be done. The Board has therefore decided to terminate its development contract with Humphreys & Glasgow, Ltd., and the production of gas and electricity at the site will cease in the early summer. Further trials will take place before then and will conclude the Board's present programme of experimental work on the underground gasification of coal.

A spokesman for Humphreys & Glasgow, Ltd., said that a great deal of experimental work had been done and the "know-how" might be very valuable in the export field. They were confident that in favourable geological conditions gas produced underground could be competitive with any other form of power station fuel. A number of the engineers and other staff employed at the Newman Spinney site would be invited to stay with the company and every effort would be made to find new jobs for the remainder.

Humphreys & Glasgow, Ltd., were appointed to take charge of the project after the National Coal Board took over its control from the Ministry of Fuel and Power. The company was to construct and operate a pilot scale gasification installation to provide gas for a 3·75 MW generating plant installed by the C.E.G.B. It was also to carry out experimental and development work, and prepare designs for a 60 MW commercial scale plant for erection should the pilot scale installation prove successful and economic.

Several countries overseas are known to have coal deposits in which underground gasification would have better chances of economic success than the thin seams on which it has been developed in this country.

Orders for Railway Modernisation Programme

MORE orders for the railway modernisation programme have been placed by the British Transport Commission. They include sixty-nine main-line diesel-electric locomotives of various horse-powers, 124 sets of electrical apparatus for the conversion of the existing Liverpool Street-Chelmsford-Southend electric trains to operate on the 50 c/s a.c. system, 124 new main-line passenger coaches with improved amenities, and fifty-four wagons for the conveyance of big loads.

Of the sixty-nine main-line diesel locomotives, forty-nine are to be delivered this year, and delivery of the remaining twenty locomotives will begin next year.

The 124 sets of electrical equipment have been ordered for the conversion of the Liverpool Street-Chelmsford-Southend electric services from the 1,500 V d.c. to the 50 c/s a.c. system to link up with future electrification on the Great Eastern main line. This equipment, which includes transformers, germanium rectifiers, and smoothing apparatus, has been designed to allow the existing electric traction motors in multiple-unit trains to operate on rectified alternating current. It is hoped to effect the changeover in 1960, when some of the rolling stock now being built for the a.c. system will be used as a temporary replacement for some of the present trains on these services while the latter are converted.

Orders for the diesel locomotives have been placed with the Brush Electrical Engineering Co., Ltd. (twenty); the English Electric Co., Ltd. (ten); the British Thomson-Houston Co., Ltd. (ten); and the Birmingham Railway Carriage & Wagon Co., Ltd. (twenty-nine). The 124 sets of electrical equipment will be supplied by the Metropolitan-Vickers Electrical Co., Ltd.

Floor Warming System Maintenance

Fault Location on Solidly Embedded Installations

By L. ARKINSTALL*

The choice between " withdrawable " or " solidly embedded " systems of floor warming cables is largely influenced by consideration of both capital cost and maintenance in the event of cable failures. The present article describes highly accurate methods of cable fault location which have been developed by the Midlands Electricity Board for all types of solidly embedded heating cables

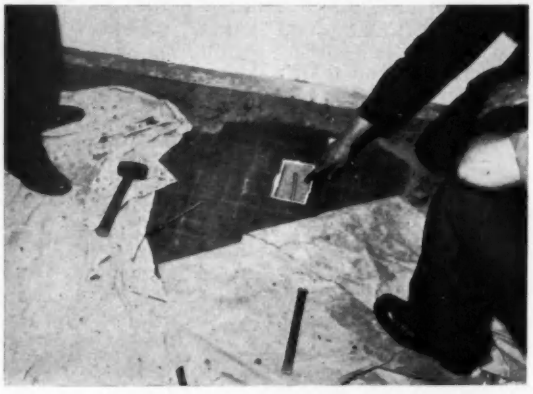
INVESTIGATIONS into the problem of fault location on " solidly embedded " floor warming systems have resulted in the development by the Midlands Electricity Board of " pin-point " location methods, which are applicable to all types of cables. These methods are so accurate that in the majority of cases it is possible to locate a fault within ¼in on any size floor and under any type of finish. This means that the total excavation necessary for both the location and repair of a fault will usually not exceed an area some 9in by 3in.

Experience to date indicates that only a very small proportion of solidly embedded systems have given trouble, and the faults which have developed have been mainly due to mechanical damage occurring either during the screeding process, subsequent excavation, or through failure of the concrete floors to withstand mechanical strains without cracking or other movement. There is no record of failure due to faulty cable.

Although various methods of fault location already exist, using " loop " tests, resistance or capacity bridges, the accuracy of these tests depends on an exact knowledge of the cable characteristics and layout, which is not likely to be available for many floor warming installations. In addition, there are some types of fault which cannot be found by these old-established methods.

The simple methods developed by the Midlands Electricity Board all rely on a positive direct identification of the fault position on the floor surface, so that excavation and repair on even the most expensive floor finish can be undertaken with confidence and minimum disturbance of the floor. The procedure depends on the type of cable, an " induction " method being used mainly for the plastic insulated types and a " hot spot " method for the mineral insulated copper-sheathed types.

The total excavation necessary for locating and repairing a fault is usually not more than 9in by 3in



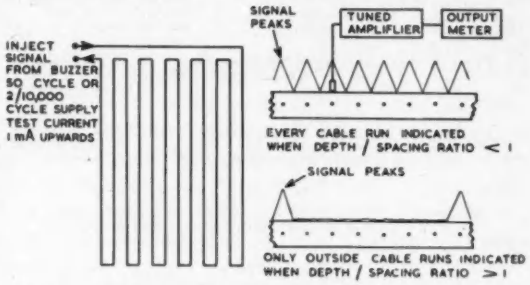

SIGNAL PEAKS
TUNED AMPLIFIER
OUTPUT METER
INJECT SIGNAL FROM BUZZER 50 CYCLE OR 2/10,000 CYCLE SUPPLY TEST CURRENT 1 mA UPWARDS
EVERY CABLE RUN INDICATED WHEN DEPTH / SPACING RATIO < 1
SIGNAL PEAKS
ONLY OUTSIDE CABLE RUNS INDICATED WHEN DEPTH / SPACING RATIO ≥ 1

Fig. 1.—Location of cable layout preparatory to locating fault (also useful when excavating floor for fixing machines, etc.)

For the " induction " test practically any valve or transistor amplifier with a simple search coil of small dimensions and almost any shape can be used, with a signal source varying from a simple buzzer operating from a dry cell or a 50 c/s supply to a valve or transistor oscillator producing a signal in the range 1 to 10,000 c/s. There is no particular reason why higher frequencies should not be used, except that in some instances capacity effects may be troublesome.

It is preferable to use a properly constructed and reliable instrument, of adequate sensitivity, as under difficult conditions it may be necessary to use an amplifier operating an output meter with a total " gain " near the million mark, when using an injection signal power of 20-40 W. At least one manufacturer is already in the process of producing apparatus of this type.

In all cases the first step in locating a fault (after isolating the circuit and establishing the fault conditions by insulation and ohmmeter tests) is to check the cable layout using the induction test set. This is necessary even where " accurate " records are available, as cable runs are often moved by the concrete screeding process, or the electrician may have used up a piece of " surplus " length in the most surprising places.

* Midlands Electricity Board.

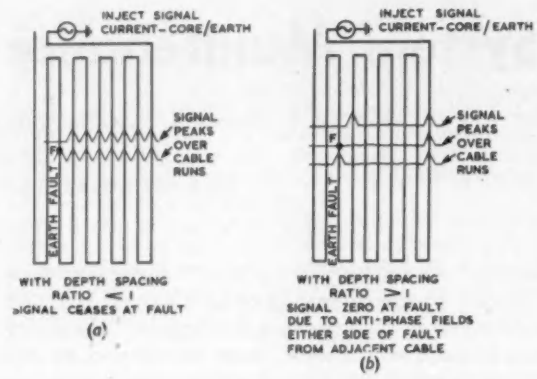


Fig. 2.—(a) Location of earth faults. (b) Non-metallic sheath

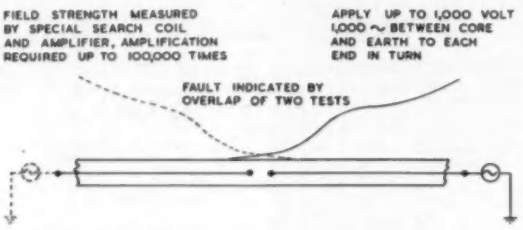


Fig. 3.—Location of open circuit faults (non-metallic sheath)

For this preliminary test the signal current is injected along the cable core (the use of single-core cables is assumed) and the magnetic field set up by this current can then be detected at the floor surface. Maximum field strength readings will be obtained directly over the cable run, which can then be marked off on the floor surface with soft chalk. It is not necessary to indicate more than the direction of the straight runs, various bends and the lead and return.

An important point to remember is that *all* the cable runs will be indicated only if the ratio between depth and cable spacing is less than 1 (approximately). If this ratio is greater than 1 only the "outside" cable runs will be indicated. This will not affect the efficiency of the fault location procedure.

The presence of faults, except open circuits with insulation values between ends or to earth higher than 1 megohm, will not affect this test, providing sensitive detection apparatus is used (see Fig. 1). Subsequent procedure then depends on the type of cable and faults.

With plastic or other non-metallic cables which are already faulted to earth, it is only necessary to pass the test signal between one end of the core and earth and with the induction set find the point where the signal ceases which, provided the depth/spacing ratio is less than 1 will be the fault position. Practically any type of search coil can be used, but "pin-point" location can be achieved only by using a coil of correct shape and design. The test current in these circumstances can be as low as 1 mA, but this will again depend on the type of search coil and amplifier being used. "Earth" in this instance normally means the concrete floor, which may or may not have steel reinforcement, or wire mesh laid over the cables. A satisfactory earth return will be any metalwork in the building structure, electrical conduit or water pipe, but not a gas pipe.

If the depth/spacing ratio is greater than 1 the fault position will be indicated by a sharp "dip" in signal strength as the search coil traverses the run of cable containing the fault. This sharp dip is caused by the search coil being under the influence of two opposing magnetic fields exactly at the fault position as indicated in Fig. 2.

If the fault resistance to earth is too high to pass sufficient test current it will be necessary to bring this resistance down by applying a d.c. or a.c. voltage between core and earth. Only limited power (up to about 100 W) must be used in this "breaking down" procedure on plastic insulated cables, otherwise the fault damage may be considerably extended. If more than one fault to earth occurs a similar test from each end of the cable will be necessary. The test is highly accurate and experience has shown that often less than an hour's work is necessary to locate and excavate the small hole in the floor necessary for repair.

Core Breakage

Occasionally, due to rough handling of the cable during laying or screeding operations, an open circuit fault develops through breakage of the cable core without damage to the flexible p.v.c. or other insulation, and in these circumstances insulation readings across the break and to earth may exceed 100 MΩ. This type of fault can usually be turned into an earth fault by establishing an arc across the break from an ignition coil or other high-voltage low power source. This will carbonise the insulation at the fault, thus enabling the test circuit to be established between core and earth as before.

If, due to the length of the break, an earth fault cannot be established it is then possible, by applying a high-frequency voltage (about 1,000 c/s, 1,000 V) between core and earth, to detect the magnetic field set up by the capacity current thus produced. In this instance the signal strength will decrease over a distance of 1 to 3ft from the fault, but an accurate location is possible by checking from each end of the cable. The fault position is then indicated by the point where the two tests "overlap" (see Fig. 3).

The procedure is different with mineral-insulated copper-sheathed cables. After the cable route has been located as with the non-metallic sheathed cable, all faults other than a "dead short" between core and sheath can usually be located by the "hot spot" method. This simply involves creating a minute 50 c/s arc at the fault position, the power fed into this arc being limited to about 60/70 W. The heating effect of this arc is local and can be detected at the floor surface within about 15 min. The hot spot will be of about 1½in diameter and 20-25

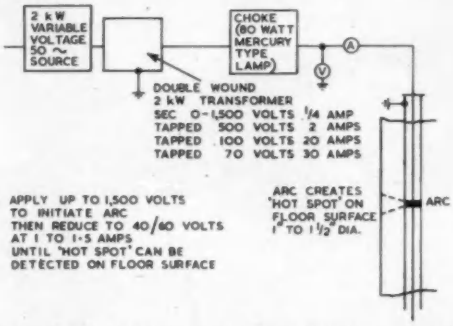


Fig. 4.—Location of faults on m.i. cables. All faults except "dead short" ("Hot spots" method)

deg F hotter than the surrounding floor. It can be detected by hand, or by instruments, using a specially developed thermistor bridge circuit.

The arc is first initiated by applying a variable 50 c/s test voltage up to the maximum test voltage of the cable (normally 1,000 to 1,500 V) with a choke acting as a current limiter. The arc can then be maintained for the requisite period with an applied voltage of 40-60 V and a current of 1 to 1·5 A (see Fig. 4). For single "dead short" faults between core and sheath, the induction test can be used by injecting the test signal between core and sheath. The fault position will then be indicated by a sharp falling off in signal strength. The success of this test depends on a balanced current (within 10 per cent) flowing in core and sheath, between the injection point and fault. If conditions are not right for this test a simple alternative is to use a variable voltage 50 c/s a.c. source and pass current along the core, through the fault and back along the sheath adjusting the current up to the maximum rating of the cable. This will rapidly heat up the floor between injection point and fault, and the extent of this heating will indicate the fault position within one or two inches, using the heat detection apparatus or testing by hand.

All these methods have been used on a number of installations of all types, with practically 100 per cent success over the last three years. In the course of time other methods may be developed, but there is now no longer any need to fear expensive repairs on solidly embedded floor warming installations.

Nuclear Reactor Auxiliaries

By B. H. STONEHOUSE, B.Sc.(Eng.), A.M.I.E.E.*

Authors' summary of a paper entitled "Design of Electro-Mechanical Auxiliaries Directly Associated with Power-Producing Reactors" by A. E. Harwood, P. Scott, M.A., and B. H. Stonehouse, B.Sc.(Eng.), A.M.I.E.E., presented at a joint meeting of the Supply Section of the Institution of Electrical Engineers and the British Nuclear Energy Conference held in London on 28th January

THREE aspects of the design of auxiliaries associated with graphite-moderated, gas-cooled reactors are discussed in the paper. These are: (a) the materials of construction, (b) the methods of drive, and (c) the control of the plant.

Radiation Damage

Apparatus working inside the reactor pressure vessel while the reactor is on load is subject to an intense flux of 10^{10} neutrons/cm^2/sec. The significant aspect of the periodic irradiation of metallic and inorganic parts in machines is the absorption of neutrons, which may make the parts radioactive, thus complicating handling and maintenance. This means, for example, that some components must be made of steels with a low manganese and cobalt content.

Significant radiation damage is sustained by organic materials used for electrical insulation, cabling, sealing gaskets, paints and greases. Studies of the effects of radiation on a range of these materials have been carried out and the nature of the damage is understood. Difficulties arise in applying available data which often refer to a different radiation flux spectrum and to different ambient conditions, both of which can significantly affect the damage. Changes in the mechanical properties of the material normally become significant before there is any appreciable change in electrical properties.

The best electrical insulating materials for operation under radiation conditions are ceramics, mineral-filled phenolics, polystyrene and polythene, but factors other than radiation-damage resistance frequently enforce a compromise decision.

Where equipment is required to work in the reactor coolant, the constructional material must not react with carbon dioxide, must be suitable for a temperature, be compatible with the fuel-element-canning material and have a low neutron-capture cross-section. This prohibits the use of materials such as cadmium, boron and the rare earths, which have high neutron cross-sections, and also of non-ferrous metals such as copper, aluminium, lead and zinc which react with the magnesium alloy used for fuel cans to form a low-melting-point alloy. The greater part of the plant is therefore made in ferrous material, while electric motors and solenoids, which are wound with copper, are totally enclosed.

Remote Control

To illustrate some of the problems that arise in the design of plant handling active material, the operations of one of the six main mechanisms in the reactor servicing machine are described. This machine is used for the withdrawal or insertion of a control rod and its mechanism while the reactor is on load. The whole sequence for the removal of a complete assembly and the substitution of a new one involves 57 mechanism operations taking 121 minutes.

If costly shut-downs of the reactor and radiation hazards to repair staff are to be avoided, the mechanisms must have the highest possible reliability. Their basic design is therefore simple and high speeds and accelerations are avoided, particularly as the shafts run in dry bearings at 100 deg C. The majority of mechanisms require motors of only one or two horsepower, and squirrel-cage induction motors are used largely because

* The General Electric Co., Ltd.

of their reliability and high power/size ratio. For motions where two speeds are required, a second motor or a double-wound machine is used in preference to remotely controlled two-speed gearboxes. Shielding is incorporated in the servicing machine to allow a repair team to work for limited periods even when the machine contains active material. In addition, the drive shafts for all the significant mechanisms are brought out through the machine's pressure vessel wall and can be driven manually.

Remote control is employed because it permits the use of a lighter biological shield on the machine and because all the control gear can be mounted in an accessible position. The decrease in the cost of the shield compensates for the increased cost of the control gear. The operator is provided with mimic-diagram control gear and with closed-loop television equipment, two TV cameras being mounted inside the servicing machine.

Despite a certain reluctance to use fully automatic controls until more operational data are available, it is considered that certain sequences should be automatic and wise selection of these controls will result in a better overall performance even if the equipment fault rate is slightly increased. The control gear is designed so that groups of operations can be arranged into an automatic sequence, the end of a group being designed to coincide with either some operation where it is vital for the operator to check the state of the machine before proceeding, or where the operator exercises some special skill or judgment in the control of the subsequent operation.

As a further example of the design principles involved, details are given of the control rod drive units. This equipment was described in the *Electrical Review* of 24th January, 1958.

DISCUSSION

Mr. K. P. Gibbs (C.E.G.B.) congratulated the authors on coming forward to discuss the basic concepts behind their design and the difficulties they had had to meet. They were right to point out that the designer's aim must be reliability and a rugged but simple type of construction. Their firm was to be congratulated on showing by the production of their machine that on-load servicing of control rods was a feasible proposition. He believed they were the first to do this and this feature was now asked for in the Generating Board's specifications. Among the more interesting features of the paper were the arguments for remote and semi-automatic control of the servicing machine and the fuelling machine. This was the correct solution, although it led to some difficulty in getting a large number of leads from the control room to the machine.

Mr. P. R. Dunn (B.I.C.C.) remarked that the conditions for the provision of cables were both arduous and novel. They involved not so much exposure to radiation as problems associated with high temperatures and mechanical service requirements. The really critical applications related to thermocouples and cables for connecting instruments.

Mr. R. H. Kelsall (Metropolitan-Vickers) said the decision to place the mechanisms completely within the gas coolant circuit, thus avoiding gas seals on rotating shafts, was a wise one and had probably prevented a lot of unnecessary difficulties. The combination of motor and brake having a separate cage winding was of particular interest because of the absence of electrical contacts to control braking under emergency conditions. The most attractive feature was the simplicity of design.

Mr. K. Dent (U.K.A.E.A., Risley) said that he never ceased to be astonished at the extraordinary absence of tradition in this field. Examples were the method of obtaining a low-frequency supply to the control rods and the bold conception of a fuel and servicing machine for changing control rods and carrying out general maintenance with the reactor on load. At the same time, the sound engineering practice evolved over the years should not be abandoned.

Mr. W. R. Cox (G.E.C.) suggested that co-operation in clearing faults would be facilitated if the charging and servicing machines were controlled from one control room instead of two. He urged that the target, in the interests of reliability, should be simplicity. Complications should be weighed up carefully, to see whether a piece of apparatus was really going to earn its keep, rather than be accepted at once.

Mr. R. B. Quarmby (Atomic Power Projects) remarked that one of the uses of the television equipment was said to be to look at the gas seal. He would have thought the real test was whether the seal let the gas through or not and viewing would not be particularly helpful. He asked whether this equipment could be used for internal viewing of the channels and whether special cooling arrangements were necessary.

Mr. D. J. E. Evans (Kennedy & Donkin) said he presumed extensive testing had been undertaken under conditions approaching as nearly as possible the conditions met with in practice. He noted that units or mechanisms would normally be available for maintenance only once a year and asked what limited their availability and what programme of maintenance was envisaged. As to the statement that until more operational data were available there was reluctance to use fully automatic controls, he pointed out that valuable experience would be gained during the early days of operation and asked whether some automatic facilities would be incorporated to take advantage of this.

Mr. P. Balmer (Metropolitan-Vickers) drew attention to the statement that the use of static rather than rotating machinery was preferable for energising the rod motors. He pointed out that at Calder Hall the phase regulator could be hand-driven by sine potentiometers with a set of d.c. resistors arranged to give approximate sine-wave three-phase output. This gave good brush wear and avoided continuous dissipation of power.

Mr. G. C. Olver (English Electric) asked about slip-ring columns and inquired whether they were intended to work in conditions of high temperature and low humidity. The great enemy of the rubbing carbon contact was a dry atmosphere, and within the reactor conditions were liable to be very dry indeed. So far a satisfactory solution had not been found to the column problem.

Mr. J. C. Williams (Babcock & Wilcox) asked whether the authors had considered the stability of the conductor materials under high temperature and irradiation conditions. Was there any embrittlement of the conductor materials? The magnetic circuit did not appear to have been considered from this point of view. With elevated temperatures and shocks causing dislocations as a result of neutron bombardment, materials might tend to demagnetise. The behaviour of magnetic alloys under irradiation conditions varied considerably with composition.

Mr. F. C. Walmsley (Micanite & Insulators) suggested that mica and mica-bonded glass could have been mentioned in the list of insulating materials.

Mr. J. Bussell pointed out that figures had been given as criteria for shut-down in emergency conditions but no attempt had been made to explain how they had been derived. Some philosophy as to this would be interesting. Did it depend on assuming some reactivity in a given time or on more detailed investigation?

Faraday Lecture

Last week the 1958-59 Faraday Lecture on "Automation" was given in London at the Royal Festival Hall which was filled to capacity. The lecture, by Dr. H. A. Thomas, discusses the meaning and application of automation and defines it as "the displacement of some of man's mental effort by machines." The elaborately illustrated lecture was described in the *Electrical Review* of 5th December after its first presentation. It is, of course, sponsored by the Institution of Electrical Engineers.

VIEWS on the NEWS

By REFLECTOR

ONE evening last week the B.B.C. television programme "Tonight" included interviews with people at Shepherd's Bush Green, London, regarding a strange object in that neighbourhood. It is a vertical cast-iron cylinder, apparently between three and four feet in diameter, ornamented in late-Victorian or Edwardian style and surmounted by a fanciful finial. Several of those questioned had not noticed it before; some thought it had something to do with the drains; one imagined it to be a police call box; and another that it was somehow used as a protection against fifth-columnists during the war. One lady thought it was something to do with lighting and she was right; it was explained that it was one of those rather elaborate transformer-distribution pillars for street lighting which once had a vogue in and around London (and probably elsewhere). Electrical men would have realised this straight away. It was not said whether the thing was still in use. I may mention that one man interviewed unkindly said:—"It can't be brass or copper or it wouldn't still be in Shepherd's Bush."

* * *

Electron, the journal of the Electrical Trades Union, publishes in its January issue an article by John A. Willey who deprecates the increasing use of imported oil for transport when electric traction has so many advantages, particularly the advantage of using home-produced fuel. I share with the author his regret at the disappearance of the trolley-bus from the London streets and, with him, would also like to see a revival of the electric "brougham." Mr. Willey, conjuring up an old dream, mentions the possibility of battery-changing stations at frequent intervals along our roads at which "electric" motorists would swap batteries. Unfortunately, such a service would have to be established well in advance of a demand which would then have to be created. This would be such an expensive and "chancy" proposition that it would be impossible to find the money for it, I am afraid. An alternative would be the development of a battery with a far greater power/weight ratio than that possessed by existing types, to enable the electric car to range over long distances. These are dreams, but nobody can believe that the internal combustion engine is the last word in transport.

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Just after reading the *Electron* article, I hit upon a report in *Achievement* of a paper presented by Dr. S. R. Millard, head of the Tropical Section of the Road Research Laboratory, on road development in the overseas territories. Dr. Millard, too, is quite sanguine about the prospect for electric traction, at least in Africa. He referred to the great hydro-electric power schemes at Kariba and Owen Falls and thought that these and the generation of electricity from atomic power, coupled with the ultimate limit on the world's resources of oil, pointed to a gradual change from the oil engine to the electric motor in inland transport. This suggested a new lease of life for the railways but also the advantages of inland transport units which could travel anywhere over a wide network of roads were such that the development of electricity as the normal propulsion for road vehicles was almost certain.

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Once again I am indebted to *Live Lines* (the journal of the Electrical Supply Authorities' Association of New Zealand) for a topic. It seems that a recent N.Z. Royal Commission reporting on local authority finance heard a submission from the Municipal Association of New Zealand that the full cost of street lighting should be borne by the power distribution authority. This was naturally opposed by the E.S.A.A. and, quite rightly, the Commission turned the suggestion down. It thought that "street lighting was a service which might properly be regarded as one which each local body should provide at its own cost." It is certainly a service which electricity supply authorities can (and do) undertake for local authorities, but to do it for nothing (on whose specification?) would be a bit too much.

* * *

Each year the Bank of London and South America publishes a useful little booklet on bank and public holidays in a number of countries, particularly Latin America. In these days of high-speed visits it is necessary to have this information for it is annoying to find that on a day planned for a visit all business establishments are closed. This seems particularly necessary in the case of Brazil for which country no fewer than fifty holidays, religious and secular, are listed. These are not all, I must say, celebrated throughout the country; some are purely local or confined to individual States. There are some specially interesting or unusual holidays, e.g. Firemen's Day (Ecuador), Discovery of America Day (several republics) and Commercial Workers' Holiday (Brazil).

* * *

It is some time since I heard of the latest perpetual motion device. I hope the quest has not been given up for I rather like the ingenious, but hopeless, contraptions which the enthusiasts have produced. Why the thought has been revived in my mind is that looking through the *Electrical Review* of 8th February, 1889, I came across the following:—

> "The Chief Clerk of the Patent Office in Washington has publicly declared that perpetual motion is an assured fact, and at the present time there are now in the Patent Office machines which have sufficient power to run themselves until doomsday. He also makes the statement that a 'machine with surplus power for the purpose of running other machinery will come some day, and may come at any time.' It can hardly be wondered at that, in view of these opinions, the American newspapers are expressing some anxiety as to the practical management of a department in which the Chief Clerk may possess some control."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The General Electric Co., Ltd., has announced the appointments of the **Hon. S. G. Catto** and **Mr. R. N. Millar,** M.A.(Cantab.), B.Com., M.I.Mech.E., A.M.I.E.E., to the board of the company.

Mr. Catto was educated at Eton and at Trinity College, Cambridge. He left Cambridge in 1943 to join the R.A.F. where he served in the Far East as a flight-lieutenant. He joined Morgan Grenfell & Co., Ltd., in 1948 and was appointed a managing director in 1957. He is also a director of Yule, Catto & Co., Ltd., and the London Australia Investment Co., Ltd. (Sydney). In the course of his work he has made extended visits to Australia and the United States.

Mr. Millar was educated at Marlborough College and, following an engineering apprenticeship at the Erith Works of the G.E.C., took the mechanical science tripos at Emmanuel College, Cambridge University. During the war he served as an engineer officer in the Royal Navy, and in 1947

The Hon. S. G. Catto *Mr. R. N. Millar*

was appointed assistant mechanical engineer to the British General Electric Co. in South Africa. While there he took another degree in economics and industrial administration. In 1952 he was transferred to Sydney, Australia, as chief mechanical engineer of the British General Electric Co., Pty., Ltd. Towards the end of 1954 Mr. Millar was recalled to England to take charge of nuclear energy developments in the G.E.C., and later that year became manager of the G.E.C.–Simon-Carves Atomic Energy Group. Early in 1957 he was appointed assistant general manager of the Erith Works of the G.E.C. and a year later became general manager. In his new appointment he will still retain overall responsibility for the mechanical and atomic engineering activities of the G.E.C. under Mr. A. L. G. Lindley, assistant managing director of the company.

Mr. T. White Wilson, a director of Plessey International, Ltd., sailed for Cape Town in the *Capetown Castle* yesterday (Thursday), where he will start a tour of South Africa and North and South Rhodesia.

Sir George H. Nelson, Bt., LL.D., chairman of the English Electric group of companies, has been elected president of the Locomotive and Allied Manufacturers' Association and **Mr. G. T. Owen,** managing director, North British Locomotive Co., Ltd., has been elected chairman of the Association for the ensuing year.

Mr. D. Halford has been appointed to the new position of progress officer for capital expenditure of Associated Electrical Industries, Ltd., and will advise on the economics of new projects, and hold a watching brief on working capital and the movement of cash. Mr. Halford was previously with the Ford Motor Co., at Dagenham, where he dealt with the control and appraisal of capital expenditure projects.

Mr. M. Braine, who has been assistant secretary of Associated Electrical Industries, Ltd., and secretary of the A.E.I.-John Thompson Nuclear Energy Co. since 1956, has been appointed general manager, central administration, and is responsible for progressing the decisions of the A.E.I. board and A.E.I. executive committee and the work of the directorate of central services.

Mr. C. Borg, who becomes general manager, personnel services, will be responsible for setting up a central personnel department working closely with A.E.I. group companies on matters of policy relating to personnel, particularly staff and including pensions. Mr. Borg was a director of Siemens Brothers & Co., Ltd., and when this company joined A.E.I. in 1955 he was elected to the board of the Edison Swan Electric Co. When Siemens and Edison Swan were merged in 1957 he looked after the integration of the district offices and sales establishments of the two companies.

Mr. B. Bonfield has been appointed assistant secretary of A.E.I., secretary of the A.E.I.-John Thompson Nuclear Energy Co. and secretary of the A.E.I. Divisional Management Co. He joined the Secretary's Department of A.E.I. in 1956.

Mr. D. Halford *Mr. M. Braine*

Mr. J. Bennett, a member of the board of A. Reyrolle & Co., Ltd., has been appointed general manager of the company, and **Mr. W. B. Fenwick,** general works manager, has been co-opted to the board.

Mr. Bennett joined the company in

Mr. J. Bennett *Mr. W. B. Fenwick*

1920 as a technical apprentice and was transferred to the Sales Department on completion of his apprenticeship. On the reorganisation of that department he was appointed assistant contracts manager, and became manager of the department in 1944. In 1953 he was co-opted to the board. He is also a director of the Bushing Co., Ltd., J. H. Holmes & Co., Ltd., Dorrator Iron Co., Ltd., and the Parolle Electrical Plant Co., Ltd.

Mr. Fenwick also joined the company in 1920 as a works apprentice and after further works and drawing office experience was attached to the Contracts Department. Following specialist responsibility from 1940 to 1946, he was in charge of the Power Supply Switchgear Division (Home Contracts) until 1951, when he was appointed East Midlands area manager, establishing a new office in Nottingham. In 1956 he returned to the works to take up the post of deputy works manager, and was appointed general works manager a year later.

Universal Metal Products, Ltd., Pendleton, Salford, celebrates its silver jubilee this year and at a recent works

Mr. C. Borg *Mr. B. Bonfield*

Sir Harold Webbe, M.P., speaking at a party held by Universal Metal Products, Ltd., to celebrate its silver jubilee. Seated (left to right) are Mr. E. G. Wertheimer, the Mayoress of Swinton and Pendlebury, the Mayor of Salford, and Mr. A. Waddington and Mr. J. G. Wilson (directors)

party gold watches were presented to employees with twenty-five years' service. The company is a wholly owned subsidiary of the Winterbottom Book Cloth Co., Ltd. Mr. E. G. Wertheimer is managing director and also a director of the parent company.

Mr. P. Scutt, A.M.I.E.E., superintendent of the Blackwall Point power station, London Division, C.E.G.B., has been appointed to a similar post at Barking "A" and "B" stations. He is succeeded at Blackwall Point by **Mr. J. W. S. Telford,** D.F.H.

Mr. Scutt was with the Brighton electricity undertaking from 1946 to 1952 and in 1953 became operation and efficiency engineer at Bankside power station. He became deputy station superintendent at Blackwall Point station in 1954. Mr. Telford has served at the London Division headquarters and was previously shift charge engineer and boiler house engineer at Earley, Southern Division.

Vice-Admiral Sir John Eaton, K.B.E., C.B., D.S.O., D.S.C., R.N. (retired), has joined Marconi's Wireless Telegraph Co., Ltd., as chief of administration at the Research and Development Laboratories at Great Baddow, Essex. In this capacity he will be responsible for all administrative matters to the chief of research, Dr. E. Eastwood.

Vice-Admiral Sir John Eaton

Mr. S. P. Maynard, B.Sc., A.M.I.E.E., has been appointed technical adviser on the steel industry to Brookhirst Igranic, Ltd. Mr. Maynard, who is a member of the Iron and Steel Institute, joined Igranic as an electrical engineer in 1929 and became successively chief designer, development manager and finally chief engineer. Brookhirst Igranic, Ltd., is a member of the Metal Industries Group.

Mr. A. D. Jacklin has been appointed chief inspector of the Metropolitan-Vickers Electrical Co., Ltd., and **Mr. W. H. Brodie** becomes assistant chief inspector. The appointments are consequent upon the retirement of **Mr. H. Annis,** chief inspector, at the end of 1958.

Mr. Jacklin received his technical education at Ipswich School of Engineering, and after his apprenticeship and practical experience in mechanical engineering he joined Metropolitan-Vickers, Sheffield Works, in 1939. He became chief inspector, Sheffield Works, in 1946 and in March last year was transferred to the Trafford Park Works as assistant chief inspector.

Mr. Brodie received his technical education at Robert Gordon's Technical College, Aberdeen, and joined the British Thomson-Houston Co., Ltd., in 1950 as a graduate apprentice. After a further period of special training he became an assistant to the chief inspector at the B.T.H. Rugby Works. In 1955 he transferred to the new factory in Northern Ireland—now A.E.I. Turbine-Generator Division's Larne Works. There he was on the works engineering staff until 1956, when he was appointed chief inspector (Larne).

Mr. A. D. Jacklin

Mr. W. H. Brodie

Mr. J. W. Potter

Mr. J. W. Potter, A.C.I.S., A.A.C.C.A., has been appointed secretary of the Metropolitan-Vickers Electrical Co., Ltd., in succession to **Mr. D. Thomson,** who has retired. He had been assistant secretary since 1956.

Mr. C. E. Akerhielm, A.M.I.E.E., has been appointed to the board of Ewbank & Partners as from 1st January. He was born in Stockholm and received his early education in Sweden, later attending Faraday House where he obtained an honours diploma. In 1940 he joined Crompton Parkinson, Ltd., at Chelmsford, working in the short-circuit test laboratory and the Switchgear Design Department. During the war he served as a captain in the R.E.M.E. in Europe and India. In 1947 Mr. Akerhielm joined the staff of A.S.E.A., Sweden, returning to join Ewbank & Partners in 1948 as assistant electrical conrtacts engineer, becoming senior contracts engineer in 1953.

Mr. C. E. Akerhielm

At the annual dinner and ball of the Croydon Branch of the **Electrical Contractors' Association,** held at Selsdon Park Hotel, Croydon, on 20th January, Mr. R. H. Springett, electrical engineer to Croydon Corporation, in proposing the toast of the Association, said that he was convinced that local electrical contractors could carry out the bulk of the installation work in connection with the large programme to be proceeded with in the re-development of Croydon, and he hoped every opportunity would be given them for tendering for this work. Mr. J. Mortimer Hawkins, in replying, said he also wished great prosperity to the Croydon contractors during the next decade. He was sure that the advance in techniques during that time would be greater than those in the last 50 years and he felt that unless the ordinary contractors worked together through the Association the complexity of the situation might well be-devil them. The chairman of the Croydon Branch, Mr. A. H. Cheesman, welcomed the ladies and the guests, and the Deputy Mayor, Councillor J. L. Aston, responded.

Mr. D. M. Embrey, co-author with **Mr. D. M. C. Dick** of the article "Speed Control of Lifts" (page 245), received his technical education at the Wolverhampton and Staffordshire College of Technology. After training with the Electric Construction Co., Ltd., he joined the company's Electronics Department in 1949 and was employed on the design and development of magnetic amplifier control systems. He later worked on the development of an electronic plating thickness controller for the tin plate industry and has most recently investigated problems in epoxy resin castings and coating systems. He was appointed senior electronics development engineer in April, 1958.

Mr. Dick was educated at Oundle School and later at the Royal College of Science and Technology, Glasgow. He joined A. & P. Steven, Ltd., in 1950 and completed an extensive practical training course with John Lang & Sons, Ltd., Bull Motors, the

Mr. D. M. Embrey

Mr. D. M. C. Dick

Igranic Electric Co., Ltd., and Dewhurst & Partner, Ltd., as well as additional training in various departments of A. & P. Steven, Ltd. He was appointed a director of A. & P. Steven in 1953 and joint managing director the following year.

Mr. J. A. Fraser has relinquished his directorships in companies in the Southern Areas Electric Corporation group and has formed a new company, J. Alistair Fraser, Ltd., at 79, Mount Street, Mayfair, London, W.1 (telephone: Grosvenor 3153), to act as sales and marketing consultants in the domestic electrical appliance industries and allied trades.

Mr. H. George B. Dickinson, M.I.E.E., has been appointed manager of the Weston-super-Mare District of the South Western Electricity Board in succession to the late Mr. H. W. Millatt, and will take up his new post shortly.

Mr. H. G. B. Dickinson

Mr. Dickinson was educated at Oundle School (Northants.) and Faraday House. After receiving his early technical training with Johnson & Phillips, Ltd., he was with that company until 1936 when he was appointed distribution engineer of the South Somerset electricity undertaking. When the industry was nationalised in 1948 he became sub-area commercial officer in Somerset for the South Western Electricity Board. Since 1950 he has been manager of the Board's Bridgwater District.

Mr. C. R. Webb, construction engineer to the London Electricity Board, retired at the end of January and at a luncheon held recently at Kettners Restaurant and a gathering at New Broad Street, his colleagues and friends were able to express their appreciation of him. The chairman presented Mr. Webb with a cheque and a list of the subscribing well-wishers.

Mr. Webb received his early practical training with the India Rubber, Gutta Percha & Telegraph Co., and the Hastings Tramway Co. After service in the Navy in the 1914-18 war and a brief period with the Western Electric Co. on cable contracts, he went to Shanghai as distribution engineer and later became chief engineer of the Shanghai Power Co. Returning home, he was appointed deputy borough electrical engineer of Hackney and, after nationalisation, he became construction engineer to the London Electricity Board on the appointment of Mr. D. B. Irving as its chief engineer.

Mr. H. D. T. Hotblack, A.M.I. Mech.E., has been appointed sales engineer of Plannair, Ltd., responsible for special air movement applications in the general engineering field. Before joining Plannair, Ltd., Mr. Hotblack was on the design staff of Balfour, Beatty & Co., Ltd.

Mr. A. McVie, B.Sc., A.C.G.I., formerly general commercial manager of Standard Telephones & Cables, Ltd., has been appointed general manager (overseas). **Mr. A. G. Slemeck,** B.A.(Oxon), who was formerly commercial manager (export), has been appointed to succeed Mr. McVie as general commercial manager.

Mr. R. E. Wilson, managing director of Fescol, Ltd., retired on 31st January. He joined the company in 1928, was appointed manager in 1932 and director in 1934, and became managing director in 1941. He is succeeded as managing director by **Mr. F. B. Strachan,** who joined the company in 1925 on the financial side and was appointed secretary in 1928. He has been assistant managing director since 1951. Under consequential staff changes **Mr. W. A. Leslie** continues as director and sales manager; **Mr. F. Baden** is appointed works manager in London and is succeeded at Port Glasgow by **Mr. C. W. Hay; Mr. A. E. Lockley** is appointed works manager at Huddersfield; and **Mr. R. F. Burke** becomes works manager of the Midlands plant.

Mr. W. M. Brown, manager, No. 2 (Bridlington) District of the Yorkshire Electricity Board, retired on 2nd January after completing over fifty years in the industry, all of which had been spent in Bridlington. At a social evening recently arranged for the purpose, a portable typewriter was presented to Mr. Brown and a travelling clock to Mrs. Brown, the presentations being made by the chairman of the Yorkshire Electricity Board, Mr. D. Bellamy, who paid a tribute to the services rendered by Mr. Brown. Further tributes were paid by Mr. C. Cameron-Kirby, the sub-area manager, who was accompanied by the sub-area senior officers, and by Mr. Wareing, the district engineer. Mr. J. E. Jenkinson also spoke on behalf of the district employees. Mr. Cameron-Kirby took the opportunity to welcome **Mr. C. R. Taylor,** Mr. Brown's successor.

Mr. D. Bellamy (left) making the presentations to Mr. and Mrs. W. M. Brown

Mr. P. G. Smyrk has joined the board of Johnson, Matthey & Co., Ltd., and has been appointed a joint managing director. He has hitherto been the manager of the export division of the company and a director of several of its overseas subsidiaries.

Mr. B. A. Williams, C.B.E., M.I.P.E., chairman of Westool, Ltd., and Williams & Williams, Ltd., has been appointed a Commander of the Order of the Crown of Belgium. The award has been made in recognition of his services to Belgian industry.

Mr. B. A. Williams

The annual ball of the East Midland Centre of the **Institution of Electrical Engineers** will be held on 20th February at the Victoria Station Hotel, Nottingham. Mr. S. E. Goodall, President of the Institution, and Mrs. Goodall, and Mr. D. E. Lambert (Centre chairman) and Mrs. Lambert will receive the guests. Applications for tickets (27s 6d each for members and 20s each for students) should be made by 9th February to Mr. J. Barnes, assistant hon. secretary, "Quiet Ways," 13, Oakwell Drive, Ilkeston, Derbyshire.

Mr. L. Anderson, B.Sc., D.F.H. (Hons.), has been appointed manager of the Water Turbine Contracts Department of the Harland Engineering Co., Ltd., in succession to **Mr. A. Feiner,** who is joining the Australian associates, the Harland Engineering (Australia) Pty., Ltd., Melbourne, as sales manager.

Mr. Anderson began his college apprenticeship in 1933 with the

Harland Engineering Co., Ltd., after leaving Manchester University, where he qualified in electrical engineering. He has held appointments with the Metropolitan-Vickers Electrical Co., Ltd., Glenfield & Kennedy, Ltd., and the Brush Electrical Engineering Co., Ltd., and has been contracts tendering manager of the Harland Engineering Co., Ltd., since 1949.

Following upon the announcement (reported on page 266) of the agreement with the Philco International Corporation, Thorn Electrical Industries, Ltd., has appointed **Mr. T. B. Henderson** as general sales manager of Philco (Great Britain), Ltd. Mr. Henderson has relinquished his appointment as sales promotion manager of "His Master's Voice" Radio & Television Sales, Ltd., to take over his new duties.

Higgs Motors, Ltd., gave a dinner and dance at the Saxon Mill, Guy's Cliffe, Warwick, on 24th January at which awards were made to members of the company who have given long service. Due to illness, the chairman, Mr. Walter Higgs, and Mrs. Higgs were unable to be present. In their absence Mr. David Higgs, managing director, presented nineteen gold watches to members who had completed thirty years' service and one retiring gift to a member who had been with the company for forty years.

Mr. S. P. J. Wood, president of the Warner Electric Brake & Clutch Co., of Beloit, Wisconsin, U.S.A., has joined the board of Westool, Ltd., St. Helen's Auckland, Co. Durham. He is a director of many other American companies and a member of the State Finance Committee for Wisconsin.

Mr. S. P. J. Wood

E. K. Cole, Ltd., announce the appointment of **Mr. F. H. Spurling** as press relations officer. He was previously in charge of the technical sales writing section of the Ekco Publicity Department, which he joined in 1951. He will operate from the company's head office at Southend-on-Sea.

Sir William Scott, O.B.E., M.I.Mech.E., M.I.P.E., J.P., managing director of Armstrong Whitworth (Metal Industries), Ltd., and **Sir Richard Bellingham Graham**, Bt., O.B.E., J.P., have been appointed directors of Head Wrightson Teesdale, Ltd., a subsidiary company of Head Wrightson & Co., Ltd.

The eleventh annual dinner and dance of the Staff Association of the **Telegraph Construction & Maintenance Co., Ltd.**, and **Submarine Cables, Ltd.**, was held at the Dorchester Hotel, London, on 30th January. A gathering of over 400 was presided over by Mr. W. R. Martin, chief personnel manager and chairman of the Association. The toast to the company was proposed by Mr. F. Mattingley (general manager, Submarine Cables, Ltd.) and Sir John Dean (chairman of Telcon) responded. Mr. C. L. G. Fairfield (director of Telcon) proposed the toast to the Staff Association and Mr. Martin replied. During the evening, gold watches for forty years' service with the company were presented by Sir John Dean to Mr. G. V. St.J. Soane (commercial superintendent, engineering), Mr. H. F. Wilson (managing director, cables group) and Mr. W. R. Martin. The guests included Mr. W. H. McFadzean, chairman and managing director of British Insulated Callender's Cables, Ltd.

Mr. W. R. Martin (left), chief personnel manager, and Mrs. Martin, and Sir John Dean, chairman of Telcon, and Lady Dean, who received the guests at the Telcon Staff Association dinner

Mr. J. A. Fraser has relinquished his directorships in companies in the Southern Areas Electric Corporation group, following the decision of the Corporation to close down production of the domestic appliances and wiring accessories marketed by its subsidiary, New Day Electric (Sales), Ltd.

Mr. D. C. Cockayne, who has been appointed assistant chief accountant, South East London Accounting Centre of the London Electricity Board, joined the former County of London Electric Supply Co., Ltd., in 1929 and served with the company until vesting date when he became principal assistant (income) in the North East Sub-Area of the London Electricity Board. Mr. Cockayne joined the Chief Accountant's Department as assistant accountant in the organisation, method and mechanisation branch in 1957.

Mr. C. R. Jones and **Mr. P. K. Richards**, B.Sc., have been appointed directors of John Thompson Water Tube Boilers, Ltd. Mr. Jones, as head of the Constructional Department, was responsible for the recent installations of steam-raising plant at Marchwood, Tilbury and Bold "B" power stations of the C.E.G.B. and is currently supervising the erection of equipment for the Board's Berkeley nuclear power station. He has also carried out important installations abroad. As a director he will have special responsibilities in the boilermaking constructional field.

Mr. Richards joined John Thompson Water Tube Boilers in 1948 as head of the Development Department and was promoted to head of the Liaison Department in 1951, with responsibility for co-ordinating the Projects and Contracts Departments. In his capacity as nuclear contracts manager—a position he obtained two years later—he was identified with the manufacture of the fast-breeder reactor vessel and the primary and secondary heat exchanger pipework for the Dounreay fast-breeder reactor station. More recently he has been concerned with equipment which the John Thompson Group is making for Berkeley nuclear power station. He will direct John Thompson's nuclear engineering projects.

Mr. R. E. McAlpine has been elected chairman of the Nuclear Power Plant Co., Ltd., in succession to the late Sir Claude Gibb.

Mr. E. D. Hart, M.A., A.Inst.P., A.M.I.E.E., for the past five years general secretary of the Scientific Instrument Manufacturers' Association (SIMA), has joined the board of Industrial Exhibitions, Ltd.

Mr. F. W. H. Shaw has been appointed deputy managing director of Submarine Cables, Ltd. (owned jointly by Siemens Edison Swan, Ltd., and the Telegraph Construction & Maintenance Co., Ltd.). Mr. Shaw was formerly assistant engineering director of Siemens Edison Swan.

Mr. F. W. H. Shaw

Mr. S. W. Podd has been appointed a director of Malcolm & Allan (London), Ltd., a Lancashire Dynamo Group company. Mr. Podd joined Malcolm & Allan in 1925 as an apprentice and became foreman in charge of various major contracts in 1932. He was promoted contracts engineer in 1941 and two years later became area engineer in charge of the Cambridge office (Air Ministry con-

tracts). Returning to London in 1947 he was appointed chief engineer to the company in 1954.

The National Council of the Incorporated Association of Architects and Surveyors has elected **Mr. R. E. J. Harding,** F.I.A.S., F.I.Arb., A.M.S.E., formerly senior vice-president, as national president for the ensuing year. Mr. Harding is surveyor to the South Eastern Electricity Board.

Mr. C. E. Walters has been appointed general sales manager of Sunvic Controls, Ltd., covering all the company's products and, in addition, he is retaining responsibility for the domestic products division. Sales managers of other divisions are: **Mr. R. Lloyd,** scientific and industrial products; **Mr. J. M. Anderson,** pneumatic instruments; and **Mr. W. J. Donnelly,** data processing. The manager of the contracts section is **Mr. E. C. Bird.**

Mr. F. S. Nicholl has been appointed managing director of D. H. Bonnella & Son, Ltd. Before joining the company as general manager in 1954 Mr. Nicholl was with H. J. Baldwin & Co., Ltd.

Mr. H. R. Rhodes, senior representative for Burco, Ltd., in the Yorkshire Electricity Board area, has retired after twenty-two years' service with the company. He is succeeded by **Mr. C. J. West,** who was previously sales branch manager to the British Vacuum Cleaner & Engineering Co., Ltd., Leeds.

Lord Bridges has been appointed a director of the Brazilian Traction, Light & Power Co., Ltd.

The Benjamin Electric, Ltd., announce that **Mr. C. H. Pellow,** manager of the southern area, will be appointed to head office at Tottenham for special sales duties, with effect from 1st March next.

Mr. Max Millar, a senior executive of the Benjamin Electric, Ltd., leaves London by air on 12th February on a business tour of the Near and Middle East.

OBITUARY

Mr. John Bridie Mavor, LL.D., M.I.E.E., M.I.Mech.E., a former chairman and managing director of Mavor & Coulson, Ltd., Glasgow, and a former chairman of the North British Locomotive Co., Ltd., died on 30th January at his home in Milngavie at the age of sixty-nine. He had been a member of the former South West Scotland Electricity Board.

Mr. Mavor was a son of Mr. Henry Mavor, founder of Mavor & Coulson, Ltd., and a pioneer in the electricity industry in Scotland. Educated at Glasgow Academy, he served an apprenticeship with the Fairfield Shipbuilding & Engineering Co., Ltd. In 1910 he entered the family business of Mavor & Coulson, Ltd. Two years later he had charge of the power unit for the first electrically propelled ship, the *Electric Arc.* In the 1914-18 war he served with the Royal Engineers and attained the rank of major. After the war he returned to the family firm, of which he became a director in 1920, and was largely responsible for the design of its mining equipment. He became chairman of the subsidiary company, M. & C. Switchgear, Ltd., and a director of the associated firm, Mavor & Coulson (South Africa), Ltd., Johannesburg. His speciality was machinery and electrical switchgear for all purposes.

In 1935 Mr. Mavor succeeded his uncle, the late Mr. Sam Mavor, as managing director of the parent company and ten years later he became chairman; he retired in 1956. In 1944 he joined the board of the North British Locomotive Co., Ltd., and became chairman in 1950, resigning from this latter office in 1955.

Mr. Mavor was a past-chairman of the I.E.E. Scottish Centre; he was also twice assessor to Rectors of Glasgow University and in recognition of his services to the university and to industry, he received an honorary Doctorate of Laws from the university in 1956. He was a governor of Glasgow Academy, of the Royal College of Science and Technology, Glasgow, and of the former Anderston College of Medicine, now incorporated in Glasgow University.

Mr. Mavor was a brother of Dr. O. H. Mavor, better known as James Bridie, the Scottish playwright.

Mr. Walter Tonkinson, who was a director and chief engineer of the Electric Construction Co., Ltd., until his retirement in 1953, died on 21st January. The funeral service at Bushbury Crematorium was attended by directors and executives from Bushbury Engineering Works, together with members of the machine design staff which he led for forty years.

The late Mr. W. Tonkinson

Mr. Tonkinson joined the E.C.C. in 1898 and became one of the Test Department's staff in 1901, transferring to the Machine Design Department in 1907 and becoming its chief eight years later. He joined the board in 1942 and continued as director and chief engineer until ill-health dictated his retirement.

B.E.A.M.A. Exhibit in South Africa

The twenty-three firms which form the Southern African Overseas Committee of the British Electrical and Allied Manufacturers' Association are staging a collective exhibit in the new British pavilion at the Rand Easter Show, Johannesburg, which will be opened by the President of the Board of Trade, Sir David Eccles, on 16th March.

The British pavilion, which is being built by the Board of Trade, is a circular building, with a dome of pale blue glass and containing approximately 10,000 sq ft of exhibition space. Each year the Board of Trade will stage a display illustrating one aspect of British industry and the remaining space will be let to British firms active in South Africa whose products are most closely related to the central display. This year the theme will be Britain's progress in the generation of electricity from nuclear power. A large central feature will illustrate the extra energy obtained from uranium compared with coal. There will be a nuclear reactor control panel linked to a model reactor, and models and diagrams will show off the research reactors available in Britain and the probable trend of development in the next 15 years.

The rest of the ground floor will be occupied by the display being organised by the Southern African Committee of B.E.A.M.A., under its chairman, Mr. D. W. Stanley, with the help of the Association's publicity department in London. The exhibit will contain many of the prize-winning models and display panels used on the electrical industry's stand at Brussels last year and it will be divided into three sections showing how British firms have contributed to the development and use of nuclear, hydro and conventional steam power generation.

On the mezzanine floor there will be exhibits by the Nucleonic, Electronic and Telecommunication Group of the British Manufacturers' & Representatives' Association.

Mission to Ghana

A Trade and Industrial Mission to Ghana is to leave the United Kingdom on 8th March, returning on 24th March. The Mission will be led by Sir George Binney, D.S.O., export director of the United Steel Companies, Ltd., and the members will include Mr. Bryan Donkin, B.A., M.I.C.E., M.I.E.E. (Kennedy & Donkin), Mr. L. H. Short, M.C., M.I.E.E., M.Inst.T. (director of overseas operations, English Electric Co., Ltd.), Mr. A. B. Waring (chairman and managing director, Joseph Lucas (Industries), Ltd.) and Mr. P. F. D. Tennant, C.M.G., O.B.E. (overseas director, Federation of British Industries).

INDUSTRY AND THE HOUSE

Points from the Electricity Debate

By A. M. F. PALMER, A.M.I.E.E., M.Inst.F., M.P.

ELECTRICITY occupied the centre of the Parliamentary stage the day the House of Commons met again after the Christmas break, the occasion being the second reading of the Electricity (Borrowing Powers) Bill. I consider this debate to be easily the best we have had since such debates became more or less regular affairs. The reason, I think, was that not too much time was given by speakers to constituency points which, although important in their own sphere, tend to obscure the discussion of the broader issues.

An interesting aspect of the debate was the intervention from the Conservative side of two ex-Ministers, Mr. Nigel Birch and Mr. Enoch Powell, once Mr. Thorneycroft's lieutenants, who armed with the prestige of their Treasury experience demanded more frequent and careful Parliamentary checks on nationalised industry financing.

Public Control over Capital Expenditure

The Electricity Bill raises the ceiling of the Boards' capital investment in England, Wales and Scotland by approximately £1,000 million to a new limit of £2,735 million. It is expected that most of this money will be needed over the next seven years and is additional, of course, to the large amounts to be drawn from the industry's own internal resources. Because of the enormous figures involved Mr. Birch contended that the measure raised again in an acute form the still unsolved problem of effective public control over capital expenditure by state industry. He seemed to be restless about the system introduced by the present Government under which this capital is found out of "below-the-line" taxation or, in other words, by compulsory saving. Mr. Birch admitted however that it was difficult to find genuine investors who wished to buy long-dated Government securities on the scale required. Mr. Powell for his part thought it would be better if electricity like coal had to come to Parliament for money every year.

How far these views are likely to receive Government confirmation I cannot say but the Labour side of the House has nothing in principle against closer Parliamentary check if appropriate machinery can be devised. That is the rub and when all is said and done money for basic industrial development must be found from somewhere. If the private investor cannot do it then the State must—which is probably the strongest single practical argument for nationalisation although, curiously enough, one rarely employed.

Mr. Maudling, the Paymaster General, who moved the second reading of the Bill, gave an interesting account, familiar to most of my readers, of the great progress of British electricity supply over the last few years. He said that 92 per cent of homes in Britain were now connected to the mains and the scope for obtaining new consumers was therefore relatively small. Expansion would take place in future more by encouraging existing consumers to use extra electricity than by breaking new ground. He pointed out—an excellent answer to the charge of wasteful expenditure—that the capital cost per kW of installed capacity was now no higher than ten years ago despite the enormous increase in the cost of materials and labour. This was to the credit of both the Electricity Boards and the manufacturers of equipment.

Sir Ian Horobin, the Parliamentary Secretary, was absent from the House because of illness or some questions might have been put about consumers coming in "hordes and droves"; but anyhow, on hire-purchase, Mr. Maudling was very direct. Now restrictions had been removed it was surely right, he thought, that on a commercial basis the nationalised industries should be allowed to take part in the general expansion of hire-purchase credit. The exact margin of credit was being discussed between the industry and the Government. They had two principles in mind: that there should not be competition over terms between gas and electricity; also that publicly owned gas and electricity should not act as hire-purchase pacemakers to traders generally.

Opening for the Opposition, Mr. Alfred Robens said that the Labour Party gave a general blessing to the Bill but the Minister should not be satisfied with doubling consumption in seven years. To encourage rural electrification it might be worth having a finance corporation so that farmers could purchase movable electrical assets not covered by easy borrowing from other quarters.

Hire-Purchase Criticism

Mr. Cooper, a London Conservative member, strongly attacked the London Electricity Board on the hire-purchase issue; he contended that the ordinary domestic consumer was subsidising cheap hire-purchase in competition with private traders who had to pay much more to finance houses. Mr. Blyton, a mining member from Durham, demanded that oil burning in power stations be ended altogether. If the use of oil was not controlled in a field where the Government could take action then coal mining was bound to suffer. It should be Government policy to see that coal was used always where it was the natural indigenous fuel. He saw no reason for making sheiks in the Middle East richer and British miners poorer.

In replying to the debate for the Opposition the writer among other things tried to give a reasoned answer to the hire-purchase criticism of the Electricity Boards. Put shortly, it is (a) that the amount of capital involved is infinitesimal in relation to total capital expenditure, (b) that utilisation activities by electricity undertakings are traditional and there is an agreement with the Electrical

ELECTRIC FLOOR HEATING PRACTICE

The series of five articles on this subject, by Mr. R. D. Jackson, published in the "Electrical Review" during December and January, are now available in booklet form. Applications for copies of the booklet (7s 6d each post free) should be made to the Publisher, "Electrical Review," Dorset House, Stamford Street, London, S.E.1, as soon as possible

Contractors' Association to ensure fair play, (c) that private contracting has continued to expand with the general development of the industry; one helps the other, (d) that British load factor improvement is urgent and can only be done if utilisation is regarded as much the business of power supply as the generation of electricity itself. And, finally, is not the true test in the end the welfare and good of the majority of consumers?

The debate last week on the freer pound was of great interest to those who follow the intricacies of international finance, and all of us know the bearing the subject has on the future of employment and trade. Certainly Mr. Gaitskell's professional talents as an economist were well displayed by his speech. After arguing that the Government should have made a greater effort to obtain a new understanding in Western Europe upon the control of exchange movements, he said that a Labour Government would have to do their best to work the new arrangements. But they would oppose any new move towards absolute convertibility. The international business of the City of London was important to the country but they could not give this business priority over the jobs and livelihood of the British people and the steady expansion of our industry.

In view of the evidence that the outcome of the General Election is likely to be very close, Mr. Gaitskell's statement is of importance, but the debate on the European Monetary Agreement Bill was in itself a quiet affair; a reasoned Opposition amendment was defeated by 308 votes to 255.

PARLIAMENTARY REPORT

Rejected British Tender

Sir David Eccles, the President of the Board of Trade, told the Commons last week that he had been to see the United States Chargé d'Affaires in London to express the grave concern with which the British Government viewed the refusal of the United States Army Corps of Engineers to accept the low tender by the English Electric Co. for turbines to be installed at the Greer's Ferry Dam.

Mr. Austen Albu, who had tabled a question on the subject, said that while not blaming American politicians for putting pressure upon their Government in the interests of their constituents—M.P.s in Britain did the same—he thought that "to change the rules in the middle of the game was really not very sporting." He asked if this decision did not make nonsense of the Government's policy of increasing trade liberalisation and moving towards convertibility.

Sir David Eccles: "Mr. Dulles himself has said that it would have been very much better if the rule had been announced beforehand. Of course, Mr. Albu is right. All countries in the free world ought to move towards a greater exchange of goods."

Mr. Jay said the whole House would support the Minister in his representations to the United States.

Lord Stonham raised the subject in the House of Lords. He wanted to know what plans the Government had for the protection of British firms who, having accepted invitations to tender in the United States, found after submitting the lowest tender that they were denied contracts on grounds of alleged "national security."

Lord Dundee, Minister without Portfolio, said the final decision must rest with the authority placing the order. But the British Government had made their views on "this unfortunate case" abundantly clear to the United States Government.

Lord Stonham said that British protests had apparently been rejected by Mr. Dulles "who, in regard to our complaints at this un-American activity, says that this was an honest decision." How could Britain free restrictions on dollar imports if the United States were able to stop our exports on any pretext? He asked the Government to seek a firm undertaking governing future dealings and, in the meantime, to demand compensation for the losses which British firms had sustained.

Lord Dundee replied that under the Buy American Act the U.S. Executive was entitled to reject any order on the grounds of national security. The matter was referred to the Office of Civilian and Defence Mobilisation who stated that if this present procurement were not awarded to the domestic producer there was reason to believe that the domestic productive capacity in the U.S. would be reduced to a level inadequate for emergency requirements. He thought the United States must be the judge of its own security. There was nothing we could do about compensation. All we could say was that this sale would have represented an extremely insignificant proportion of America's total need of the kind of material in question; that the security issue was not raised until the last moment; and that this sort of action did not increase confidence in the sincerity of the American Government in carrying out the liberal trading policies into which we and they have entered.

Compulsory Arbitration

Replying to Mr. Prentice, the Minister of Labour (Mr. Iain Macleod) said there was a large measure of agreement between the representatives of industry that some form of compulsory arbitration should be continued and he hoped to move a clause in the Committee stage of the Wages Councils (Amendment) Bill to cover this matter.

Electrical Road Heating

In reply to Mr. Rankin, Mr. Harmar Nicholls, Parliamentary Secretary, Ministry of Works, said he recognised the success of electrically heating road surfaces. Good results were being achieved from the investigations at the Road Research Laboratory, as was shown by the way abnormal weather conditions were being dealt with.

Mr. Woodburn said Edinburgh Corporation was at present considering electrifying the road on The Mound to keep it ice-free.

Protection of Consumers

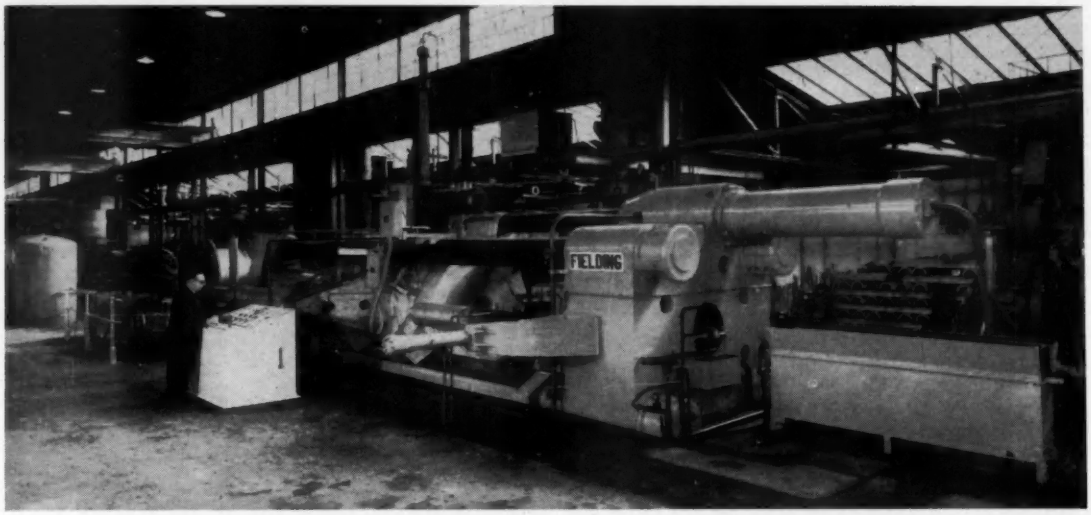
Miss Burton asked the President of the Board of Trade whether he was aware that the Advisory Council on Standards for Consumer Goods, sponsored by the British Standards Institution, had recommended the establishment of an independent national body representing every aspect of consumer interest.

Sir David Eccles said he was considering this important matter in conjunction with other more general problems of protection of the consumer and hoped to make a statement shortly.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £238 10s 0d
Fire Refined 99·70%	ton £237 0s 0d
Fire Refined 99·50%	ton £236 0s 0d
COPPER Tubes ..	lb 2s 3½d
Sheet	ton £268 0s 0d
H.C. wire and strip	ton £292 15s 0d
LEAD, English ..	ton £70 15s 0d
Foreign	ton £69 0s 0d
MERCURY	flask £74 0s 0d
TIN, block (English) ..	ton £766 10s 0d
ZINC, G.O.B. Foreign	ton £72 15s 6d
BRASS Tubes (solid drawn)	lb 1s 10½d
Wire	lb 2s 7¾d
PHOSPHOR BRONZE Wire	lb 4s 1½d
PLATINUM	oz £19 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 24¾d—25d



Aluminium Cable Sheathing

DIRECT EXTRUSION METHOD DEVELOPED BY HACKBRIDGE

A CONTRACT for 7,536 yd of 300-pair aluminium-sheathed telephone cable (approximate outside diameter 1·5in) has just been completed for the G.P.O. by the Hackbridge Cable Co., Ltd. The aluminium sheath of this cable is directly extruded over the cores and is subsequently protected with a sheathing of polythene. It is understood that this is the first contract for telephone cables sheathed in this manner, although several experimental lengths have been supplied in the past.

One of the reasons for selecting aluminium as the sheathing material is its high electrical conductivity compared with lead (about eight times as good) and this property has special merit as a screening medium to reduce the severe interference associated with high-voltage single-phase electrical transmission and will be employed by British Railways under the modernisation scheme.

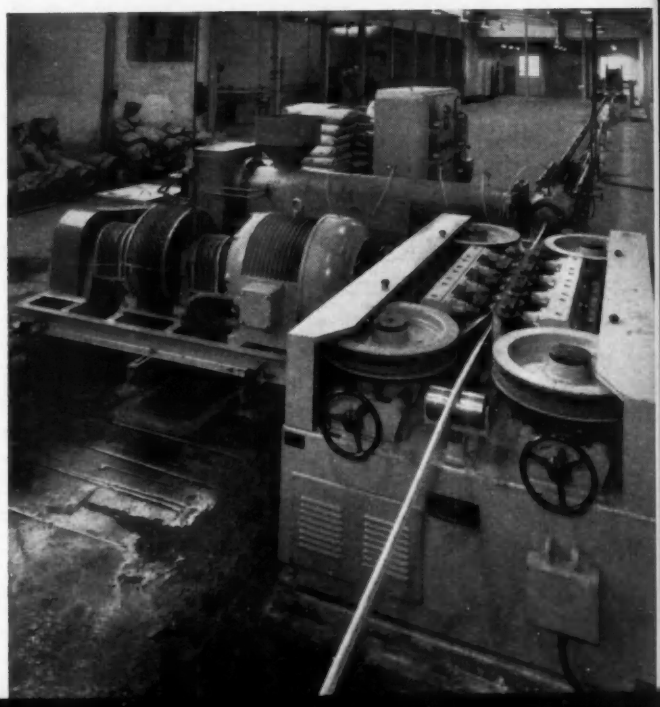
Extrusion Process

There are many novel features associated with the application of the aluminium sheathing to the cable. In the first place the aluminium, supplied by the British Aluminium Co., Ltd., is of super-purity grade (99·99 per cent or better). The press employed has a maximum capacity of 3,600 tons and was supplied by Fielding & Platt, Ltd. The indirect method of extrusion is employed which makes use of a moving container. The press is of horizontal construction and the billets weigh 300 lb with a container bore of 13in. The die box is of porthole design with a four-point entry requiring the four streams to "weld" completely in the mixing chamber. The mandrel is bored to permit the passage of the naked cable.

The speed of extrusion is about 50 lb/min. Thus, with a cable diameter of about 1¼in and with a wall thickness of 0·070in, extrusion speeds of up to 150 ft/min are obtained. Because of the size of the billets it was possible to sheath in one operation lengths up to 250 yd, the advantage of this being that it eliminates completely "stop marks" which, generally, are a source of weakness. Examination of the sheath indicates that there is no "weld" or seam weakness.

One difficulty associated with the extrusion of aluminium is the relatively high temperature necessary compared with lead. In the contract now completed the container temperature was between 400 and 450 deg C,

Above: Aluminium extrusion press at the works of the Hackbridge Cable Co., Ltd., showing aluminium billet in position on the mandrel before charging the aluminium press. Below: Polythene sheath being applied to extruded aluminium cable



and at these temperatures, even with the rapid rate of extrusion achieved, unless precautions are taken, there arises the serious difficulty of charring of the insulation. This was overcome by a method covered by British Patent No. 632,534 where a very thin aluminium foil with paper backing is applied to the cable immediately under the sheath.

The sequence of operation of the extrusion press starts with the pressure ram withdrawn vertically clear of the axis of the press and the container at the rear of the press. A preheated bored billet is then assembled on the mandrel which is moved out of line with the axis of the press for ease of loading.

The mandrel and billet are then moved across into position and the containers brought forward under hydraulic pressure until the billet is enclosed within the container. The pressure ram is then lowered and moved forward, making a seal between itself and the mandrel and between itself and the container. Continued movement of the pressure ram pushes forward the container, at the same time forcing the aluminium through the die box in the form of an extruded pipe over the naked cable passing through the hollow mandrel. The movement of the container and ram together has the advantage of eliminating the frictional losses which would exist between the perimeter of the billet and the container. The cable with aluminium sheath is then passed through a series of cooling water jets and so on to the take-up drum.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication.
Responsibility cannot be accepted for the opinions expressed by correspondents.

Single- or Double-pole Fusing

IN this week's *Review* (23rd January), "Reflector" tells of a town in Yorkshire where in certain houses there was no electricity, while at the same time in others all sorts of electrical appliances were burned up due to excess voltage, indicating a live neutral due to mains trouble. "Reflector" infers that no fuses or circuit-breakers operated, but surely they would not do so, at least not until the excess voltage had produced the conditions to make them operate.

It is fairly safe to assume that somewhere or other in Great Britain this trouble occurs almost every day to a greater or lesser degree, and makes complete nonsense of the term neutral conductor which is "permanently and effectively earthed," a term used in I.E.E. Regulations and on which unfortunate and erroneous assumption the use of single-pole and neutral gear with unfused neutral is advocated.

The policy of the National Inspection Council in trying to enforce the use of this gear against the wishes of experienced engineers who prefer d.p. fusing, must therefore be open to the severest criticism, and should be challenged.

Similarly Electricity Boards which demand single-pole and neutral gear, should be required to undertake in writing full responsibility for any damage caused by a live neutral.

The writer is very concerned as to who would be held responsible should serious damage such as "Reflector" described occur in premises where there was an unsuspected earth fault on the neutral side of the wiring installation when a mains fault occurred making the neutral alive.

"CATEGORY III."

Thermo-Nuclear Power

IN your editorial of 2nd January you refer to the possibility of producing electricity direct from a fusion reaction without the intervention of a heat engine and state that "the economic advantages of such an arrangement over all existing types of generating equipment are obvious."

I submit that the *theoretical* elegance is apparent but the *economic* advantage is by no means so. Economics can be discussed only of practical things, i.e. those which have been achieved or are in sight of achievement. A *prima facie* case for economic utilisation of fusion by no means follows even if a method were known to trigger off a fusion reaction or if practical means to maintain it by some sort of chain reaction could be visualised. Merely dispensing with heat engines does not necessarily result in competitive power; thermocouples, animal muscle, tidal mills and windmills already do it, but they are not overwhelmingly competitive, nor are glow-worms for lighting in spite of their technical elegance.

Esher, Surrey. B. WOOD.

13 A Socket Outlets

IN answer to Mr. C. A. Cameron Brown's letter of 30th January may I say that I have lived in a house fitted with these sockets for nearly five years and have found them most satisfactory in all respects.

A reasonable amount of force is needed to insert the plugs and I have never known one to fall out or come out easily. I would not like to return to the circular pin type which most certainly suffered from the troubles your correspondent alleges against flat pins.

Is it possible that the socket outlets complained of have been made by a firm of poor repute which uses metal for the sockets which is too thin and not springy enough?

Barton-on-Sea, Hants. R. H. ROBINSON (Chartered Electrical Engineer).

Heavy-Oil Burning

IN a paper read at the Institute of Marine Engineers on 27th January, Dr. J. S. Clarke and Mr. G. J. Hudson (Joseph Lucas, Ltd.) discussed the properties of various heavy-oil fuels with special reference to fuel injection and atomisation, droplet evaporation and carbon deposition. The authors defined two types of combustion equipment—combustors (with enclosed flame) and registers (with open flame), the first exerting lateral and longitudinal control of the flame, which the other did not. The combustor was used generally when the main flame had to be kept external to a boiler and the register when the flame was within the boiler so as to achieve best heat transfer to the fluid. They then described the development of a method of controlled toroidal recirculation for securing flame stabilisation for both combustors and registers in industrial applications, in particular for the conversion of Lancashire boilers from coal firing to oil firing.

Plant and Machinery Rating

A COMMITTEE appointed by the Ministry of Housing and Local Government, under the chairmanship of Sir Edward H. Ritson, to prepare a revised statement setting out in detail all the machinery and plant which appeared to the Committee to fall within any of the classes specified in the Third Schedule of the Rating and Valuation Act, 1925, has now issued its report (H.M. Stationery Office, price 2s 6d).

This report begins with an account of the history of the rating of plant and machinery since the beginning of the century with a number of legal opinions on various points. Representations made to the Committee are set out in some detail. It was contended by some parties that the detailed list included in the Third Schedule of the 1925 Act should be abolished on the grounds that it was impracticable to make it complete, that technological advances made it out of date, and that the list was a fruitful source of disputes and litigation. The Committee thinks, however, that as the list was compiled largely on the generic principle the addition of a comparatively few items would make a satisfactory list under modern conditions.

The Committee agrees that the definitions of primary transformation and main transmission in the Plant and Machinery (Valuation for Rating) Order, 1927, have the effect of rating electric power more severely than any other form of power. It has therefore produced revised definitions of " main transmission of power " and " transformer " to right this situation. The alteration thus made will afford a relief to heavy users of electricity. Gas turbines have been inserted under (*b*) of the Schedule to Class 1 (*a*).

Consideration was given to the rating of atomic plant. The Committee expresses the opinion that, apart from the plants of the electricity generating boards (which are subject to special rating arrangements) " there are unlikely for some years to be reactors producing power as their primary product." Therefore at present no provision should be made for reactors in Class 1 of the Schedule; reactors and accelerators (for research purposes) should be included in Class 4. Other items which it is proposed should be added to Class 4 include boilers; heat exchangers, recuperators and regulators; main pipelines; fixed gantries; radar and television masts; precipitators; radio telescopes; and wind tunnels.

It is recommended that the word " parts " in the heading of Class 4 shall be replaced by " items," and that ancillary moving parts shall not be rated. A majority of the Committee considers that power-operated plant which moves or rotates should be exempt, and that small movable items of plant should not be rated.

The Minister proposes to make a new Order, based on the Committee's recommendations, to come into force on 1st April. He will take into account any representations on the Committee's report received in the Ministry by 28th February.

Electrical Imports in 1958

IMPORTS of electrical machinery, apparatus and appliances in 1958 (as briefly mentioned last week) rose by 11 per cent to £29·6 million, which was a slightly lower rate of increase than that recorded in the previous year. Imports of heavy electrical plant increased by only small amounts, but there were more important increases in electronic valves (£387,108), radio communication and navigational aid equipment (£888,378), cooking and heating apparatus (£438,192) and scientific electrical instruments (£452,357). Imports of cathode ray tubes fell by over £1 million and the value of imports of domestic radio sets and of complete portable electromechanical appliances was also less than in the previous year.

The United States (£8 million) continued to be the largest source of imports, followed by Western Germany (£5·8 million) and the Netherlands (£4·1 million). Electrical imports from the Commonwealth were valued at £3·1 million.

TABLE I.—ELECTRICAL IMPORTS

Class	1957	1958
	£	£
Generators, including parts	801,773	897,731
Motors, including parts	1,150,390	1,105,530
Rotary convertors, mercury-arc rectifiers and transformers rated at not less than 1 kVA on continuous load	347,047	386,324
Switchgear and switchboards (other than telegraph and telephone)	535,910	630,429
Valves, electronic, excluding X-ray valves (whether separately consigned or with the apparatus of which they form a part), complete	1,584,266	1,971,374
Cathode ray tubes, complete	1,619,716	458,791
Parts of electronic valves and cathode ray tubes (excluding glass bulbs)	380,740	378,685
Apparatus for radio, television and radar—		
Radio receiving sets of the domestic or portable type, and radio for motor vehicles	392,172	246,883
Radio communication and navigational aid (including radar) equipment, complete	2,715,152	3,603,530
All other apparatus, parts and accessories	4,123,197	3,864,531
Apparatus for telegraphy and telephony	1,227,353	1,425,775
Welding machinery other than tube making (excluding welding electrodes)	344,612	337,773
Electrical cooking and heating apparatus (other than for motor vehicles)	1,161,169	1,599,361
Magnetos, ignition, and electric appliances for aeroplanes, motor vehicles and cycles	2,069,506	2,625,045
Electro-medical apparatus (including X-ray apparatus, tubes and valves)	988,416	992,663
Portable mechanical appliances, electrically operated—		
Complete	1,182,411	1,111,089
Parts	623,922	840,021
Scientific electrical instruments (excluding telegraphic and telephonic)	1,507,574	1,961,931
All electric machinery, apparatus and appliances, not elsewhere specified	4,007,269	5,147,664
TOTAL	26,762,595	29,585,130

TABLE II.—SOURCES OF ELECTRICAL IMPORTS

Country	1956	1957	1958
	£	£	£
Australia	341,151	458,661	716,812
Canada	1,269,654	853,249	967,567
Other Commonwealth countries	1,084,990	1,288,049	1,469,998
Irish Republic	898,060	998,319	898,431
Sweden	1,028,356	996,511	1,121,789
Denmark	487,930	426,584	623,274
Western Germany	3,951,149	4,986,441	5,780,205
Netherlands	3,736,189	4,092,165	4,124,159
Belgium	414,472	991,143	578,741
France	733,714	1,011,775	1,261,006
Switzerland	1,185,873	1,133,183	1,526,248
Italy	513,521	569,880	858,881
United States of America	7,075,397	7,708,165	8,018,333
Other foreign countries	960,892	1,248,470	1,639,686
TOTAL	23,681,348	26,762,595	29,585,130

INDUSTRIAL NEWS

Lamp Price Reductions

With effect from 2nd February the prices of Crompton "Whitelight" and 150 W rating "Charmlight" lamps are appreciably reduced. The 150 W "Charmlight" lamps are reduced from 3s 9d to 3s 4d each, 40 W and 60 W "Whitelight" lamps are reduced from 2s 5d to 1s 11½d, and 100 W "Whitelight" lamps are reduced from 2s 10½d to 2s 6½d. All prices include purchase tax.

As from 1st February the prices of "Mazda" 40 W and 60 W coiled coil silverlight lamps, manufactured by the A.E.I. Lamp & Lighting Co., Ltd., have been reduced from 2s 5d to 1s 11½d and the price of the 100 W lamp from 2s 10½d to 2s 6½d. The prices of the 150 W and 200 W single coil silverlight lamps remain unchanged at 3s 9d and 5s 1½d respectively. All prices quoted include purchase tax. The Mazda "Netabulb" 100 W lamp is also reduced in price from 2s 10½d to 2s 6½d (including purchase tax). Additions to this range are 60 W and 150 W white-coated lamps and a 150 W lamp with a pearl finish. All have coiled coil filaments. Prices of the new lamps are: 60 W 1s 11½d; 150 W (coated) 3s 9d; and 150 W (pearl) 3s 1½d.

The General Electric Co., Ltd., announces that the prices of "Osram" silverlight lamps in the popular sizes have been reduced, the price of 40 W and 60 W lamps from 2s 5d to 1s 11½d and 100 W lamps from 2s 10½d to 2s 6½d (including purchase tax).

E.T.U. on Employment Situation

The state of electrical employment is an indication of general industrial conditions in an area, for electrical work enters very largely into all the principal industries. Each month *Electron*, the Electrical Trades Union journal, publishes reports from the Union's area officials upon conditions in various parts of the country. The January reports give the following indications:—

In Northern Ireland the state of employment has remained poor; about 700 electricians have been paid off by Harland & Wolff, Ltd., but they are expected to be re-employed in February. In the Glasgow area a number of people have been discharged upon the finishing of a fairly large shipbuilding job. It can be expected that the position will worsen over the next few weks "and we will probably face unemployment for the first time in a decade."

Much time is being spent by the Middlesbrough E.T.U. officials in dealing with redundancy but "everybody seems to be optimistic that there will be a turn for the better." Vacancies in the Manchester area are said to be "virtually non-existent"; unemployment is becoming more pronounced, particularly in contracting. At Chester there is said to have been no marked change in the employment situation, although new work is scarce. In the Birmingham area "redundancy is showing itself in places like I.C.I. and the Ministries, but elsewhere employment seems to be holding." Since the last report employment in the Bristol area has improved but some E.T.U. members are still looking for work. It is hoped that in the near future there will be a further improvement as several contracts open up. During the last few months unemployment in the London area has increased, although it is said to be in no way serious.

National Inspection Council

The National Inspection Council for Electrical Installation Contracting is holding a meeting at the Conference Room, Civic Centre, Southampton, on 11th February (2.30 p.m.) and invitations have been sent to local authorities, architects, builders and consulting engineers. The purpose of the meeting is to explain the objects and methods of operation of the Council, and to show how it can be of assistance to them. Ald. R. R. H. Hammond, the Mayor of Southampton, will be in the chair.

Liverpool Port Radar

A new port radar station equipped with the Decca type 32 harbour surveillance radar was officially opened on 2nd February at the Gladstone Dock of the Mersey Docks and Harbour Board. This station has been built and equipped to replace the original installation brought into operation in July, 1948, since when 5,332 vessels of almost 28 million gross tons have received radar assistance. The total cost of this re-equipment is about £72,000. Three-centimetre wavelength radar equipment of exceptionally short pulse length, and v.h.f. frequency modulated radio equipment, has been installed in a new building. Seven fixed coil 15in displays, all fed from the one radar source, enable every part of the port approaches to be surveyed in detail.

The operations room of the Gladstone Dock radar station

Thorn Electrical Industries and Philco

An agreement between Thorn Electrical Industries, Ltd., London, and the Philco International Corporation, New York, is announced under which all of Philco Corporation's radio and monochrome television engineering knowledge, designs and developments will become available through a licence to Thorn Electrical Industries for the manufacture and sale of these products in the United Kingdom. In addition Thorn Electrical Industries acquires all the issued capital stock of Philco (Overseas) Ltd., Philco's radio and television manufacturing unit in Great Britain. Philco (Overseas), Ltd., also owns Philco's British sales company, Philco (Great Britain), Ltd. It is intended that both these companies will continue to operate as at present constituted, as units in the Thorn group.

Thorn Electrical Industries will manufacture export models of radio and television receivers under the "Philco" trademark for Philco International Corporation's overseas distribution. Thorn's will also continue the manufacture and sale of radio and television receivers and radiogramophones, under the "Philco" trademark in the United Kingdom market. Treasury consent to the arrangements has been applied for.

The agreement with Thorn will in

no way affect Philco's arrangements with Semi-conductors, Ltd., London, in the field of transistors, nor its relationship with the Bendix Home Appliances, Ltd., Birmingham, in the home laundry equipment field.

Hawker Siddeley Industrial Activities

Sir Roy Dobson, managing director of the Hawker Siddeley Group, announced on 28th January that all the industrial activities of the Hawker Siddeley Group have recently been brought together into one industrial company—Hawker Siddeley Industries, Ltd. The new company will be under the chairmanship of Sir Roy and the joint managing directors are Sir George Briggs and Mr. A. Frampton. There are two deputy chairmen —Mr. H. T. Chapman and Mr. H. G. Herrington, and the board includes Mr. J. F. Robertson (finance); Mr. C. F. Barnard, Mr. M. C. Clear (export sales); Mr. D. K. Fraser, Dr. B. L. Goodlet, Mr. W. S. Warner and Mr. P. C. Sharp (secretary). The industrial group consists of the following companies:—Brush Electrical Engineering Co., Ltd.; Fuller Electric, Ltd.; Hawker Siddeley Brush Turbines, Ltd.; Hawker Siddeley (Hamble), Ltd.; High Duty Alloys, Ltd.; J. & H. McLaren, Ltd.; Kelvin Construction Co., Ltd.; Mirrlees, Bickerton & Day, Ltd.; Norstel, Ltd.; Petters, Ltd.; Templewood Hawksley, Ltd.; and the National Gas & Oil Engine Co., Ltd.

English Electric Service Centre

The English Electric Co., Ltd., has moved its service centre this week from Hampstead to premises at 231, The Vale, London, W.3 (telephone: Shepherds Bush 9311), where it will be able to extend servicing facilities over the whole of London and the South Coast south of a line from Lyme Regis to the Wash. The new depot covers over 15,000 sq ft of floor space, four times greater than the Hampstead depot, and houses extensive appliance and television workshops, stores, administrative offices and garage. There is also a section for "off-the-shelf" sales of spare parts for the full range of appliances. In addition to the resident technical staff, a team of service engineers will operate throughout the territory with fleets of vans fully equipped as mobile workshops. Facilities at the depot include equipment to rebuild an appliance completely and for re-spraying, as well as a routine replacement service. Mr. E. Foster continues as depot manager, with Mr. W. E. Walmsley as service supervisor.

Guildhall Lighting

Four 20-light crystal glass and silver bronze metal chandeliers have been installed for the Corporation of London in the Livery Hall of the City of London's Guildhall. Designed by the architects, Sir Giles Gilbert Scott, Son & Partners and manufactured by the General Electric Co., Ltd., each chandelier is 4ft 6in in diameter and 9ft high. The crystal glass dressing on each fitting comprises 1,300 drops specially made in cruciform shape. General lighting in the hall is by fluorescent tubes in coves below the ceiling.

Chandeliers manufactured by the G.E.C. installed in the Livery Hall of the City of London's Guildhall

Willesden Technical College

To mark the twenty-fifth anniversary of the opening of the Willesden Technical College, Denzil Road, Willesden, N.W.10, a silver jubilee exhibition is to be held at the College from 23rd to 28th February. The exhibition will cover all aspects of the work of the Building and Engineering Departments, particularly local industry. A number of firms whose apprentices are students at the College will be staging demonstrations, and films on topics of general interest will be shown. The exhibition will be open to the public, free of charge, from 10 a.m. to 8.30 p.m. each day (Saturday 10 a.m. to 5 p.m.).

B.I.C.C. Cardiff Branch

The inauguration of the new premises at Cardiff of British Insulated Callender's Cables, Ltd., was performed by Mr. W. A. Gallon, chairman of the South Wales Electricity Board, on 28th January. Some 150 business associates attended the ceremony in the new offices at Station Terrace, Queen Street, Cardiff. The building replaces the offices in Hills Terrace, which have been in use since 1937, and has a total floor area of 9,000 sq ft and a storage capacity of 80,000 cu ft on the ground, second and third floors, providing accommodation five times greater than previously available. The first floor is used for office accommodation, and an electric goods lift has been installed to facilitate the handling of stocks between ground, second and third floor levels. The branch will carry a comprehensive range of B.I.C.C. products. The new branch is under the management of Mr. L. R. Greet, who has managed the Cardiff branch since January, 1953.

At the opening ceremony Mr. Gallon referred to the company's long associations with the electricity supply industry in South Wales, mentioning the cable laying and overhead line erection carried out for the South Wales Electrical Distribution Co. in the early 1900s.

New Nuclear Engineering Company

Saunders-Roe, Ltd., has become increasingly interested in certain specialised fields of nuclear engineering and during the last twelve months close contact has been maintained with Nuclear Enterprises (G.B.), Ltd., Edinburgh. As a result of this association the two companies now announce the formation of a new jointly owned company, Saro-Nuclear Enterprises, Ltd., with head office at 53, Parliament Street, London, S.W.1. The activities of this company will cover the fields of applied irradiation and the application of isotopes to industrial processes.

Selling Fires in North America

How personal visits, hard work and initiative resulted in a 400 per cent rise in exports of electric fires to the United States and Canada is recounted by Mr. L. G. Bettinson, export manager, Berry's Electric, Ltd., in this week's *Board of Trade Journal*.

Though "visiting the market and knocking on doors" is an essential ingredient of dollar sales success, Mr. Bettinson emphasises that it is not sufficient on its own. He describes how he overcame the reluctance of American retailers to import direct with an ingenious scheme that not only eliminated the importer's paper work but encouraged him to place larger

orders. At one time during the second tour last year orders were flowing in so fast that his company had to discontinue production for the home market for nearly a month and start a double-shift six-day week. North American sales now total about a third of all Berry's exports, which go to ninety-five countries. Mr. Bettinson wrote on selling methods in the United States in our issue of 31st January, 1958.

Cinema Contest

One of the major prizes in a national contest during February celebrating Associated British Cinemas' 30th anniversary will be a range of English Electric appliances including a "Slimline" refrigerator, automatic control cooker and a washing machine with immersion heater and pack-away wringer. Prizes worth over £2,000 can be won, including £450 in cash. Arrangements have been made by English Electric and A.B.C. to give full support to local electrical dealers who wish to co-operate with cinema managers by putting in foyer displays including duplicates of the prizes, through co-operative advertising schemes and posters.

Refrigerator Film

A new one-minute full-colour film promoting refrigeration, made by the English Electric Co., Ltd., in association with Rank Screen Services, will be available for dealers and Electricity Boards from mid-February. The film may be ordered for showing at any cinema, and where bookings are made by dealers at local cinemas costs will form part of the English Electric Co.'s co-operative advertising scheme, and the dealer's name and address will be shown at the end of the film.

Training College Installation

In the village of Bradenham, Bucks., is a manor house which at one time was the home of Disraeli, and is now administered by the National Trust. The British Tabulating Machine Co. has recently taken over this manor as an executives' training college. The bedrooms, lecture rooms and dining rooms have been completely redesigned. The old kitchen has been modernised and fitted with new equipment, supplied by Stotts of Oldham, in conjunction with Murrays (High Wycombe), Ltd., contracts furnishing section. All-electric catering equipment is installed in the kitchen including the following:—Electric range; steamer; deep fryer; toaster; hotcupboard with bain marie top; electric café set; mixer; peeler; and slicing machine.

Canopy Space Heaters

The accompanying picture shows an installation of "Metrovick" radiant space heaters at Wades, the new furnishing store in Liverpool. The weatherproof heaters consist of anodised aluminium reflectors housing 3 kW tubular sheathed elements, and operating at red heat they project a radiant heat on to the shoppers below. The store is of the modern open design, and in the warmth from the heaters the shoppers can see the whole ground floor display in comfort. Additionally, by reducing the difference between inside and outside temperatures, the heaters form an excellent means of preventing condensation or frosting on the display windows.

"Metrovick" radiant space heaters fitted into the canopy of a Liverpool store

Scientific Instrument Research

Griffin & George (Research & Development), Ltd., has been formed by the Griffin & George Group to conduct research into, and the development of, new and improved scientific instruments and apparatus for laboratory use and process control. The research director is Dr. A. J. P. Martin, F.R.S. New laboratories to house the research and development staff will be designed and equipped.

Batti-Wallahs' Society

The first luncheon of the year of the Batti-Wallahs' Society, which was held last week at the Connaught Rooms, London, attracted a large gathering of members, and they were well rewarded with an excellent discourse by Mr. Walter Winterbottom, the England soccer team manager, who spoke on international football, more particularly as it affected international relationships, in which he indicated that generally football played an important part in international understanding. Mr. H. H. Spencer, the president, was in the chair, and Mr. J. W. Perkins (a past-president) proposed a vote of thanks to Mr. Winterbottom. Mr. T. C. F. Bigland (the "Mate") announced that the speaker at the next luncheon (Thursday, 26th February) would be Sir Christopher Hinton.

Hollerith-Powers-Samas Merger

International Computers & Tabulators, Ltd., a new company resulting from the merger of the British Tabulating Machine Co., Ltd., and Powers-Samas Accounting Machines, Ltd., began business on 30th January. The I.C.T. employs some 16,000 people and its assets are valued at nearly £24 million.

A new streamlined range of I.C.T. equipment, covering both punched card apparatus and electronic computers, will gradually be introduced and the full integration of the companies will be accomplished stage by stage. The previous association of B.T.M. with the General Electric Co., Ltd. (in Computer Developments, Ltd.), and with the Laboratory for Electronics, Boston, U.S.A., will be continued in the new company; the future of the link between Powers-Samas and Ferranti, Ltd., is still under discussion.

Sir Cecil Weir, chairman of I.C.T., said that a key factor in arranging the merger had been the desire to promote a larger overseas trade by both direct export and local manufacture. In particular they hoped to trade in Europe in a much bigger way. At present exports represented about one-third of total production.

Col. A. T. Maxwell (previously chairman of Powers-Samas, Ltd.) and Mr. H. V. Stammers are the deputy chairmen of the new company. Mr. A. H. Hird is the vice-chairman and Mr. C. Mead the managing director.

European Refrigeration Association

European manufacturers of refrigeration equipment have met for discussion on several occasions in the last four years. At a meeting in Brussels during May last year the discussion resulted in the formation of the Comité Européen des Constructeurs de Matériel Frigorifique (C.E.C.O.M.A.F.), the headquarters of which are in Paris. Membership is open only to the national trade association and was intended originally to be confined to the six countries of the European Common Market. The Council of the British Refrigeration Association, however, formed the view that the new Association should be truly European, although it was recognised that manufacturers in the six Common Market countries would have problems which they might wish to discuss on their own. The United Kingdom delegation, Mr. J. A. Howie (managing director, Lightfoot Refrigeration Co., Ltd.), Mr. K. J. R. Cocke (director, Prestcold Division, Pressed Steel Co., Ltd.) and Mr. T. Whittaker (director, British Refrigeration Association), pressed this view, and at a meeting in Milan in December last it was agreed to throw the membership open to all countries in O.E.E.C., the Common Market countries to have their own smaller

group under the chairmanship of M. R. Malengret-Lebrun (Belgium).

A technical committee has also been set up under the chairmanship of Dr. von Cube (Germany) grouping the delegations from Belgium, Denmark, France, Germany, Italy, Switzerland and the United Kingdom. This committee proposes to assist the work of the International Institute of Refrigeration and the International Standards Organisation by ensuring that national delegations to each are aware of the point of view of the manufacturers.

Technical Education Journal

We have been sent a copy of the first issue of *Technical Education*, to be published monthly by Evans Brothers, Ltd., Montague House, Russell Square, London, W.C.1 (2s 6d per copy). The aims of the new journal are, firstly, to serve the practical needs of those concerned with technical education in schools and colleges and with training in industry. Secondly, it intends to encourage further contacts and exchange of opinions and, thirdly, to stimulate research on the problems of technical education. The field covered by the journal includes technical colleges, the colleges of advanced technology and to some extent the universities and the secondary modern, technical, grammar and comprehensive schools.

"Mazda" Filmlet Viewer

The A.E.I. Lamp & Lighting Co., Ltd., has equipped each of its "Mazda" sales representatives with a miniature hand-operated film viewer showing a shortened version of the new "Mazda" television "commercial." The "Filmoscope" is a plastic film viewer made by Airfix, Ltd., with a ratchet-operated spring-loaded device which takes a continuous strip of 8 mm film.

Diesel Generators for Holland

The accompanying picture shows a diesel generator set leaving the Colchester works of Davey, Paxman & Co., Ltd., for shipment to Holland. Four units, with a total output of 1,080 kW at 1,200 r.p.m., are being supplied for a diesel-electric oil well drilling project. The sides are hinged, the top halves opening upwards to form a roof and the lower halves opening downwards to form a walkway. Placed side by side all four units thus constitute a self-contained power house.

Industrial Lighting Fittings Catalogue

Crompton Parkinson, Ltd., have issued a well-produced publication in which particulars are given of their "New-Range" industrial fluorescent lighting fittings and accessories, floodlights, continuous trunking, exterior lighting fittings, fittings for tungsten and electric discharge lamps, blended light fittings, bulkhead fittings, workshop brackets, flameproof fittings, and control gear. The publication is profusely illustrated.

International Materials Handling Conference

The Institute of Materials Handling is holding its first international conference from 6th to 8th May next at the Waldorf Hotel, London, and has issued preliminary details of the programme. Particulars can be obtained from the Conference Office, 42, Manchester Street, London, W.1.

Trade Announcements

Printed Circuits, Ltd., of Borehamwood, Herts., one of the pioneer manufacturers of copper etched wiring circuits, who recently became associated with the London Electric Wire Co. & Smiths, Ltd., is about to establish an information service in the form of a series of technical bulletins, to provide the latest information on production techniques and recent applications. Those wishing to receive these brochures are asked to write stating their interest.

Winn & Coales, Ltd., have formed a Contracting Department to carry out the protection of plant, pipelines, structural steelwork, etc. For the present it will operate from the northern area headquarters:—Denso House, Glebelands Road, Sale, Ches. (telephone: Sale 8271). This company now provides a complete anti-corrosion service—including cathodic protection (in conjunction with the "Denso" system). Inquiries relating thereto should be addressed to the head office:—Denso House, Chapel Road, London, S.E.27 (telephone: Gipsy Hill 4247).

An arrangement has been concluded between **Davis & Timmins, Ltd.**, and **Wade Couplings, Ltd.**, whereby Davis & Timmins have been appointed distributors and stockists of the Wade range of compression pipe couplings. Existing sales arrangements will not be disturbed. A considerable expansion is planned in the range of Wade products.

Simms Motor Units, Ltd., has opened a branch in Carlisle. The business of Smith's Electrical Service Station, 25, London Road, Carlisle, has been acquired, the proprietor, Mr. W. Smith, with his son joining the Simms organisation. The new branch will be under the management of Mr. E. Dorning.

The permanent magnet business previously carried on by the **English Steel Rolling Mills Corporation, Ltd.**, has been transferred to the English Steel Magnet Corporation, Ltd., North Street Works, Openshaw, Manchester, a newly formed wholly owned subsidiary of the parent company, the English Steel Corporation, Ltd. The chairman of the Magnet Corporation is Mr. R. G. H. Taylor, and Mr. E. J. C. Patrick, formerly manager of the Tool Steel Department, has been appointed director and general manager. Mr. F. S. Beale and Mr. P. Turrell have also been appointed directors, and Mr. A. M. Simmers has been appointed secretary.

Electric & Musical Industries, Ltd., Hayes, has installed a new private automatic branch telephone exchange at a cost of £50,000 which came into operation on 2nd February.

The **Simplex Electric Co., Ltd.**, has opened a new branch at 27, Franklin Street, Belfast, and Mr. W. D. Hunter, B.Sc., A.M.I.E.E., has been appointed manager.

The branch office at Derby of **British Insulated Callender's Cables, Ltd.**, is now at Hartington Street, Derby. The telephone number (Derby 41421) is unchanged.

Mr. R. J. Vassald has been appointed technical sales representative for the electrical products of **Thomas French & Sons, Ltd.**, in the Midlands and the South of England.

Black & Decker, Ltd., announce that following the lifting of the embargo on dollar imports, it is introducing into the United Kingdom market a selected number of tools manufactured by the Black & Decker Mfg. Co., Towson, Maryland, U.S.A.

Advertisement Correction

In the advertisement of Shimwell Alexander & Co. in our 30th January issue the telephone number should have been given as Avenue 4761.

A diesel generator leaving the Colchester Works of Davey, Paxman & Co., Ltd., for dispatch to Holland

GENERATION and DEVELOPMENT

Plant for Northfleet Power Station

The Central Electricity Generating Board has placed an order with the General Electric Co., Ltd., for a further two 120 MW reheat turbo-generator sets for Northfleet, Kent, power station. The contract includes the condensing and feed-heating plant and is valued at over £2,500,000.

This latest order covers the last two sets for the station so that all six of the 120 MW machines to be installed at Northfleet will be of G.E.C. design and manufacture. The first set, now in course of erection at site, was ordered in 1955, and an order for two further sets followed early in 1956. The fourth was put in hand in 1957.

The six machines are all of similar design for operating with steam conditions of 1,500 lb/sq in and 1,000 deg F, with reheat to 1,000 deg F. Each machine has an h.p., i.p. and l.p. cylinder arranged in a single lnie. After expansion to 415 lb/sq in in the h.p. cylinder, steam passes to the reheat section of the boiler at a temperature of 700 deg F, and is returned to the i.p. turbine at a pressure of 375 lb/sq in and a temperature of 1,000 deg F. After expansion in the i.p. turbine, steam passes through twin overhead pipes to the double-flow l.p. turbine. The alternator rating is 150,000 kVA at 0·8 p.f., and cooling is by means of hydrogen at 30 lb/sq in. The rotor is cooled by hydrogen passed through hollow copper conductors, permitting the construction of a machine of relatively small overall dimensions. For an output of 120 MW, the designed vacuum is 28·9in of mercury, with a final feed temperature of 435 deg F.

Shin Scheme Stations in Operation

The first and most important sections of the North of Scotland Hydro-Electric Board's Loch Shin scheme—the 3,500 kW Lairg power station and the 24,000 kW Shin station—have now been brought into commercial operation. These two stations, which will have an annual output of 113 million kWh, both make use of the water of Loch Shin.

The Lairg station is incorporated in the structure of a dam across the narrows west of Lairg. Water from this station is discharged into what may now be called "Little Loch Shin," the level of which is maintained by a dam across the River Shin. From the lower dam the water is diverted through a tunnel to the main station at Inveran.

At the diversion dam the installation of a small generating set has been almost completed. This machine will produce 100 kW from the compensation water which is discharged to maintain fish life in the River Shin. The turbine is of particular interest because it is enclosed in a casing of tubular form, one of the first in this country.

The Cassley works at the western end of Loch Shin are still under construction. When completed later this year, this station will have a capacity of 10,000 kW and will produce 24 million kWh per annum.

The output of the Shin scheme stations will be fed into the Highland grid at Inveran and Lairg. The civil engineering consultants for the Shin scheme are Sir Murdoch MacDonald & Partners, the electrical and mechanical consultants are Messrs. Kennedy & Donkin, and the architects for the Shin and Lairg stations Messrs. Shearer & Annand. The main civil engineering contractors in the Shin and Lairg sections are George Wimpey & Co., Ltd., the generating plant being manufactured by Bruce Peebles & Co., Ltd., and Boving & Co., Ltd.

Unusual Steam Drum

The steam drum shown in the accompanying photograph is the first of four produced by Thos. Firth & John Brown, Ltd., to the order of Mitchell Engineering, Ltd., for the Central Electricity Generating Board's Skelton Grange power station. It was loaded on Friday, 23rd January, at the Atlas Works of Firth Brown, Sheffield, on a special railway bogie flat wagon, the only one of its type in this country having a capacity of 100 tons, and arrived on the Skelton Grange sidings on Monday, 26th January.

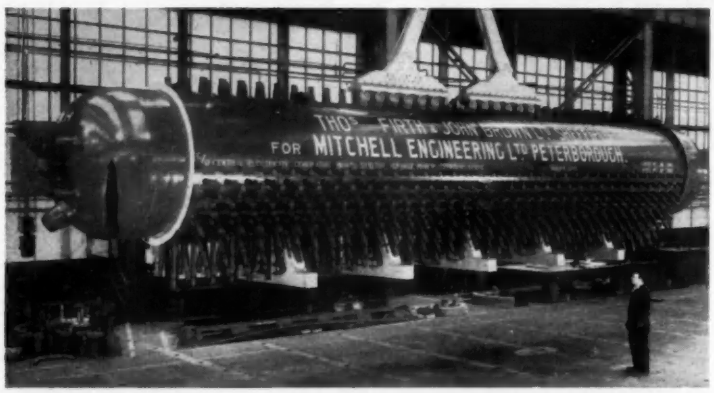
This 85 ton drum, 47ft long, has a 66in bore, is fitted with 879 welded stub tubes and attachments instead of the usual expanded boiler tubes, varying from 9 to 27in, and was made for a design pressure of 1,850 lb/sq in. The drum was constructed from two hollow forged half drums, each with an integral closed end, and the two halves were then joined together with a centre circumferential weld seam 5¼in thick. When assembled with a smaller receiver drum and burning 55 tons of coal per hour, it will evaporate more than 860,000 lb of water into steam which, passed through a single turbine, will generate 120,000 kW.

Responsibility for Meter Testing

A suggestion that the public would be better served if the responsibility for testing gas, electricity and water meters were vested in local authorities under the Weights and Measures Acts was recently made to the Association of Municipal Corporations by the West Bromwich Borough Council. Commenting on this, the Association's General Purposes Committee says it has carefully considered this matter on two occasions and has borne in mind the views expressed in 1951 by the Hodgson Committee on Weights and Measures. It does not believe that the results achieved would justify the disturbance caused and concludes that gas and electricity meters should be specifically exempted from the weights and measures law because of other provisions designed to protect the public. The Committee does, however, urge that the Minister of Power should consider the desirability from the consumers' point of view of statutory provision for the periodical re-examination of electricity meters.

Floor Warming Tariffs

The Housing Committee of the Association of Municipal Corporations reports that Leyton Borough Council, which has approved the use of electricity for floor warming in a number of housing schemes, recently suggested that the Association should make representations to the Minister of Power for the introduction of a special



Forged steel drum—named "The Porcupine"—made by Thos. Firth & John Brown for Skelton Grange power station.

tariff for electricity supplied for installations of this kind. The Committee says it understands that Electricity Boards already encourage this type of heating by specially reduced tariffs. It is considered preferable for local authorities to approach their own Boards on the general question of such tariffs than for the A.M.C. to make representations at a national level.

All-Electric House Costs

Allegations that the tenants of all-electric houses on the Farringdon Estate, Sunderland, are paying electricity bills up to £80 a year have been denied by the North Eastern Electricity Board (Wear Area). The Board stated that an examination of its records showed that the annual electricity bills for the houses ranged from £24 6s 1d to £58 3s 4d, the average being £42 8s 10d. These figures indicated that it was possible to use electricity for cooking, lighting, water heating and room heating and operate one or two small appliances for 17s 6d a week, with no outlay for coal or gas.

Trolley-Bus Route Extension

Bradford Transport Committee has approved a scheme submitted by the general manager for the provision of public transport to the Holm Wood estate, and authority has been given for the erection of overhead wiring required for the extension of the trolley-bus service at a cost of £12,630.

OVERSEAS

Plant for Transvaal Power Station

A *Reuter* message from Pretoria states that the English Electric Co., Ltd., has obtained a contract valued at £248,930 for supplying condensing plant for the new Transvaal power station. The contract, awarded by the Pretoria City Council, is the result of negotiations with the English Electric Co. after twelve tenders had been rejected. This is the company's second major contract for plant at the power station. Its tender for the supply of a turbo-alternator at £1,196,700 had been previously accepted.

Russia's Seven-Year Plan

The Soviet seven-year plan announced by Mr. Khrushchev last week provides for an increase in industrial output of about 80 per cent, in production of investment goods of 85 to 88 per cent and of consumer goods of 62 to 65 per cent.

By the end of the seven-year period it is planned that electric power output should be increased to 500,000-520,000 million kWh a year (233,000 million kWh in 1958), while the rated capacity of power stations will be more than doubled. Consumption by industry will increase by 120 per cent and electric power per worker will nearly double. Mr. Khrushchev said that to win time and to use capital investments most effectively priority would be given to the construction of thermal stations. Nevertheless, provision has been made for the construction, among others, of the following hydro-electric stations: Bratsk, 3,600 MW; Stalingrad, 2,530 MW; Krasnoyarsk, 4,200 MW; Kremenchug, 625 MW; Bukhtarama, 525 MW; Votkinsk, 1,000 MW. The world's largest hydro-electric stations are being built on the Angara and Yenisei rivers and the share of the eastern areas in the total output will rise to 46 per cent.

The seven-year plan envisages the further unification of power stations into large power systems with a view to establishing a single power system for the Soviet Union. Several nuclear power stations with different kinds of reactors will be brought into operation and all the country's trunk railway lines, totalling nearly 100,000 km, will be converted to electric or diesel traction towards the end of the period.

22 kV cable being installed in Singapore; some 200 drums of this 0·3 sq in 3-core H type, paper insulated and lead alloy sheathed cable are being supplied by Siemens Edison Swan, Ltd., for the city's distribution system

Dominican Hydro Scheme

It is announced by the Dominican Republic Embassy in London that the Government of the Republic is inviting overseas concerns to submit proposals for a hydro-electric project on the river Nizao. The proposed dam will store 600 million cu m of water and have a capacity of 135,000 kW. Combined with the hydro-electric scheme will be an extension of the aqueduct for the capital, Ciudad Trujillo, which is designed to meet the estimated needs of the city over the next twenty years. The plan also makes provision for a water purification plant at San Cristobal. The irrigation canal system in the Bani area is to be considerably extended. Further details of the scheme may be obtained from the Oficina del Ingeniero Asesor del Poder Ejecutivo, Ciudad Trujillo, Dominican Republic.

Geothermal Power for Mill

It is reported in *Live Lines* (the official organ of the Electrical Supply Authorities' Association of New Zealand) that the Tasman Pulp & Paper Co. proposes to generate electricity from geothermal steam at its mill at Kawerau and is buying a 10,000 kW power plant from England. Operation is expected to commence some time in 1960. Heat exchangers have also been ordered from Italy to provide steam for process work. Sir James Fletcher, chairman of the company, said that this was part of a scheme that would ultimately cost millions of pounds and was designed to save a great deal of money in fuel and power costs.

East European Power Exchange

A scheme for the exchange of power between Austria and Czechoslovakia began operating last month, reports *Reuter*. Under an agreement between the two countries, Austria will export 200 million kWh from its hydro-electric stations between April and September when water from the melting Alpine snow provides a surplus, while Czechoslovakia will return 100 million kWh from its steam power plants between October and March. A high voltage line 79 miles long has been constructed between Sokolnice in Czechoslovakia and Bisamberg, near Vienna.

The construction of joint hydro-electric stations on the Danube is also proposed. One of these will be on the river west of Bratislava where the dam will be the fifteenth in the "Danube Cascade" plan. Several other joint stations are to be built under an agreement between Czechoslovakia and Hungary.

P.O.A. Conference

The Purchasing Officers' Association is holding its 1959 Minibition, in conjunction with the annual conference, at Folkestone from 24th to 26th September. The theme will be "Industry's Shop Window." Details can be obtained from the Association, Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4.

DOMESTIC ELECTRICAL EQUIPMENT

WASHING MACHINES

THERE can be few homes in this country in which no form of laundry work is carried out, but the number of households possessing electric washing machines is still only about one in every five. Sales figures have, however, increased considerably in recent months.

The size and composition of a family are the chief considerations when buying a washing machine and manufacturers offer three main types. There are the smaller models that take up to about 4 to 6 lb dry weight of clothes and are usually provided with a hand type wringer; the more popular standard size with an average capacity of 9 lb dry weight of clothes and fitted with a powered wringer; and the fully automatic models. These last-named types are capable of carrying out a complete cycle of operations which wash, rinse and dry the clothes, nearly ready for ironing, without the necessity of constant supervision. To these three main types of washing machine may also now be added the combined washing machine and spin dryer. Several more models have come on to the market since we last published a survey on this subject and particulars are given of a half dozen or so different makes. Details are also given of the latest "Goblin" washing machine, model W.150, although this will not be marketed until the early spring.

Manufacturer or Distributor	Name or Model	Type	Size (H.W. & D. in inches)	Tub Capacity (Dry Clothes)	Loading if Heated	Method of Operation	Type of Wringer	Pump
ADA (HALIFAX), LTD., Westmount Works, Halifax, Yorks.	Mark I "Balmoral"	Cabinet	35×22×22	9 lb	2¼ kW	Rotary agitator	Power	Yes
	Mark VII "Coronation"	Cabinet	30×18×18	5 lb	2¼ kW	Rotary agitator	Power	Yes
	"Ada-matic"	Cabinet	33×30×18	5 lb	3 kW	Rotary agitator	Spin dryer	Yes
A.E.I.-HOTPOINT, LTD., 33, Grosvenor Place, London, S.W.1.	"Empress" (heated)	Cabinet	36×22×22	9 lb	3 kW	Gyrator	Power	Yes
	"Empress" (unheated)	Cabinet	36×22×22	9 lb	—	Gyrator	Power	Yes
	"Countess" (heated)	Cabinet	33½×17½×19	6 lb	2 kW	Gyrator	Power	Yes
	"Princess" (heated)	Cabinet	33½×17½×18	6 lb	2 kW	Gyrator	Hand	Yes
	"Princess" (unheated)	Cabinet	33½×17½×18	6 lb	—	Gyrator	Hand	Yes
	Table top for "Empress," £2 7 3 plus 5s 3d pur. tax. Plastic cover and rinse bowl for "Princess," £2 16 9 plus 6s 3d pur. tax							
BENDIX HOME APPLIANCES, LTD., Albion Works, Kingsbury Road, Birmingham, 24.	"D"	Cabinet	36×26×22	9 lb	—	Tumble action	Spin dry	Yes
	"GH"	Cabinet	36×30×26	9 lb	2 kW	Tumble action	Spin dry	Yes
	"G"	Cabinet	36×30×26	9 lb	—	Tumble action	Spin dry	Yes
	"MH"	Cabinet	36×26×22	9 lb	2¼ kW	Tumble action	Spin dry	Yes
	"M"	Cabinet	36×26×22	9 lb	—	Tumble action	Spin dry	Yes
BRITISH VACUUM CLEANER & ENGINEERING CO., LTD., Goblin Works, Leatherhead, Surrey.	"Goblin" W.150	Cabinet	30½×17½×17½	4/6 lb	2¼ kW	Oscillating agitator	Hand	Yes
	"Goblin" W.150U	Cabinet	30½×17½×17½	4/6 lb	—	Oscillating agitator	Hand	No
BRUNLEC APPLIANCES, LTD., Junction Mills, Burnley.	"Vortex"	Cabinet	29½×16×17½	4/5 lb	3 kW	Pulsator	Hand	Yes
BURCO, LTD., Rose Grove, Burnley, Lancs.	122 H	Cabinet	31½×19×21	5½ lb	2½ kW	Agitator	Hand	No
	122 HP	Cabinet	31½×19×21	5½ lb	2½ kW	Agitator	Hand	Yes
CONTINENTAL WASHING MACHINE CO., LTD., 63, Great Eastern Street, LONDON, E.C.2.	"Jetmatic"	Cabinet	33×30×22	10 lb	2 kW	Jet washing action producing circulatory tumbling motion	Spin dryer	Yes (two)

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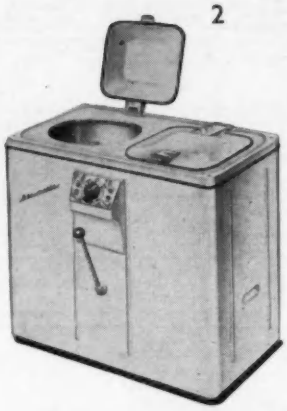

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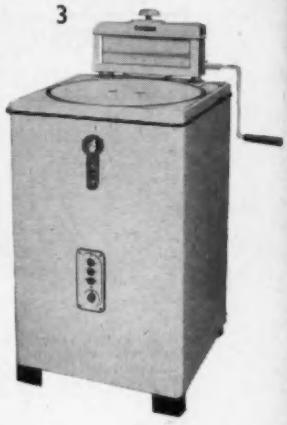
1. *Burco model 122HP washing machine*
2. *"Ada-Matic" combined washing machine and spin dryer*
3. *British Vacuum Cleaner & Engineering Co.'s "Goblin" model W.150*
4. *Ada "Coronation" Mark VII washing machine*
5. *A.E.I.-Hotpoint "Empress" washing machine*
6. *Brunlec Appliances "Vortex" washing machine*
7. *Bendix "Dialamatic" tumble action washer*



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Exterior Finish	Tub Finish	Price (excl. tax)	Purchase Tax
Cream or white enamel	Aluminium	£53 0 0 £46 0 0 (non-heated)	£11 12 6 £10 1 10 (non-heated)
Cream or white enamel	Aluminium	£49 4 10 £42 14 6 (non-heated)	£11 1 7 £9 12 3 (non-heated)
Cream or white enamel	Aluminium	£69 6 7	£15 4 2
Cream or white stoved enamel	Aluminium	£67 6 4 £54 4 11 (without wringer)	£14 11 8 £11 18 1 (without wringer)
Cream or white stoved enamel	Aluminium	£57 13 10 £44 15 6 (without wringer)	£12 13 2 £9 16 6 (without wringer)
Cream or white stoved enamel	Vitreous enamel	£56 16 7	£12 9 5
Cream or white stoved enamel	Aluminium	£48 4 2 £38 14 11 (without wringer)	£9 10 10 £8 10 1 (without wringer)
Cream or white stoved enamel	Aluminium	£41 6 5 £31 17 2 (without wringer)	£8 0 7 £6 19 10 (without wringer)
Vitreous porcelain enamel	Vitreous porcelain enamel	£79 12 1	£18 0 11
Vitreous porcelain enamel	Vitreous porcelain enamel	£101 0 1	£22 17 11
Vitreous porcelain enamel	Vitreous porcelain enamel	£98 8 9	£22 6 3
Vitreous porcelain enamel	Vitreous porcelain enamel	£70 3 9	£15 18 3
Vitreous porcelain enamel	Vitreous porcelain enamel	£66 15 4	£15 2 8
White enamel	Vitreous enamel	£42 18 6	£8 15 10
White enamel	Vitreous enamel	£36 0 6	£7 5 7
Cream or white vitreous enamel	Vitreous enamel	£35 0 0	£7 3 4
White with red accessories or cream with red or eau-de-nil acces.	Anodised aluminium	£37 10 0	£7 13 0
White with red accessories or cream with red or eau-de-nil acces.	Anodised aluminium	£40 0 0	£8 4 0
Stoved enamel	Vitreous enamel	£72 10 0	£15 14 0

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Manufacturer or Distributor	Name or Model	Type	Size (H.W. & D. in inches)	Tub Capacity (Dry Clothes)	Loading if Heated	Method of Operation	Type of Wringer	Pump
CONTINENTAL WASHING MACHINE CO., LTD. *(continued)*	"Twinmatic"	Cabinet	30×19×21	6 lb	2 kW	Agitator	Spin dryer	Yes
CO-OPERATIVE WHOLESALE SOCIETY, LTD., National Works, Hall Street, Dudley, Worcs.	"Dudley" 7501	Round	46×25×27	6 lb	—	Central reversing gyrator	Power	No
	"Dudley Invincible" 7700	Cabinet	36×21½×21½	6 lb	2 kW	Central reversing gyrator	Power	Yes
C.P. PLASTICS, LTD., Enterprise Works, Scunthorpe, Lincs.	"Cotto" M.15/6	Cabinet	30×18×18	5/7 lb	—	Impeller	Power	No
EASICLENE PORCELAIN-ENAMEL (1938), LTD., Lord Street, Wolverhampton.	E.W.1	Cabinet	28×16×16	4½ lb	—	Agitator	Hand	Gravity drainage hose
	E.W.4	Cabinet	28×16×16	4½ lb	2·7 kW	Agitator	Hand	Gravity drainage hose
ENGLISH ELECTRIC CO., LTD., Domestic Appliance Division, East Lancashire Road, Liverpool, 10.	4004	Cabinet	48⅛×21½×23⅝	8/9 lb	—	3-fin central agitator	Power	Yes
	4005	Cabinet	48⅛×21½×23⅝	8/9 lb	2½/3 kW	3-fin central agitator	Power	Yes
ENTWISLE & KENYON, LTD., P.O. Box. 39, Ewbank Works, Accrington.	"Ewbank" H.W.1	Cabinet	36×22×20	4½ lb	—	Plastic vaned agitator	Hand	No
	"Ewbank" H.W.2	Cabinet	36×22×20	4½ lb	—	Plastic vaned agitator	Hand	Yes
	"Ewbank" H.W.3	Cabinet	36×22×20	4½ lb	3 kW	Plastic vaned agitator	Hand	No
	"Ewbank" H.W.4	Cabinet	36×22×20	4½ lb	3 kW	Plastic vaned agitator	Hand	Yes
	"Ewbank" P.W.10	Cabinet	36×20½×23	4½ lb	—	Plastic vaned agitator	Power	Yes
	"Ewbank" P.W.11	Cabinet	36×20½×23	4½ lb	3 kW	Plastic vaned agitator	Power	Yes
H. FROST & CO., LTD., Walsall.	"Sunhouse"	Cabinet	30½×14½×17½	5 lb	—	Gyrator	Hand	Gravity emptying
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	DE.210A	Cabinet	36×22½×22½	8 lb	—	Plastic agitator	Power	Yes
HOOVER, LTD., Perivale, Greenford, Middlesex.	Mark II	Cabinet	30½×17½×16½	6 lb	2 kW	Pulsator	Hand	Yes
	Mark III	Cabinet	30½×17½×16½	6 lb	2 kW	Pulsator	Power	Yes
	"Hoovermatic"	Cabinet	31½×29½×16½	6 lb	3 kW	Pulsator	Spin dryer 2,000 r.p.m.	Yes

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8. *English Electric model 4005 washing machine*
9. *Easiclene model EW.1 washer*
10. *Continental Washing Machine Co.'s "Twin-matic" combined washing machine and spin dryer*
11. *Entwistle & Kenyon "Ewbank" model P.W.11 washing machine*
12. *C.W.S. "Dudley" model 7501 round type washer*
13. *G.E.C. model DE.210A washing machine*
14. *C.P. Plastics "Cotto" M.15/6 washing machine*
15. *H. Frost & Co.'s "Sunhouse" washer*
16. *Hoover Mark III washing machine*

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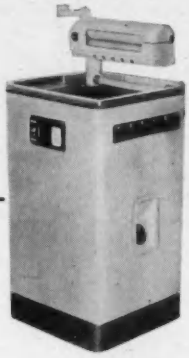
Exterior Finish	Tub Finish	Price (excl. tax)	Purchase Tax
Vitreous enamel	Vitreous enamel	£57 16 8	£12 10 4
Vitreous enamel	Vitreous enamel	£37 10 0 (a.c.) £45 18 9 (d.c.)	£9 0 0 (a.c.) £11 0 6 (d.c.)
Stoved enamel	Vitreous enamel	£55 3 0 £50 0 0 (non-heated)	£12 8 3 £11 5 0 (non-heated)
Cream or white stoved enamel	Aluminium	£41 14 0	£8 0 6
Stove enamelled	Porcelain enamel	£33 11 3	£6 14 4
Stove enamelled	Porcelain enamel	£38 15 6	£7 17 3
Cream or white stoved enamel	Alkali resisting vitreous enamel	£53 7 9	£11 14 3
Cream or white stoved enamel	Alkali resisting vitreous enamel	£61 2 9	£13 8 3
Ivory stoved paint	Porcelain enamel	£39 19 4	£7 18 5
Ivory stoved paint	Porcelain enamel	£41 13 5	£8 5 10
Ivory stoved paint	Porcelain enamel	£46 3 5	£9 5 7
Ivory stoved paint	Porcelain enamel	£47 17 2	£9 13 1
Ivory stoved paint	Porcelain enamel	£51 0 0	£11 3 10
Ivory stoved paint	Porcelain enamel	£55 6 8	£12 2 10
White stoved enamel	Anodised aluminium	£35 10 1	£7 5 11
White stoved enamel	Vitreous enamel	£57 13 1	£12 12 11
White enamel	Stainless steel	£44 10 0 £39 0 0 (non-heated)	£9 6 9 £8 2 0 (non-heated)
White enamel	Stainless steel	£54 4 6 £48 14 6 (non-heated)	£12 4 0 £10 19 3 (non-heated)
White stoved enamel, grey stoved enamel aluminium lid, blue base	Stainless steel washer tub, aluminium spin dryer tub	£71 13 9 £67 6 10 (non-heated)	£16 2 8 £15 3 1 (non-heated)



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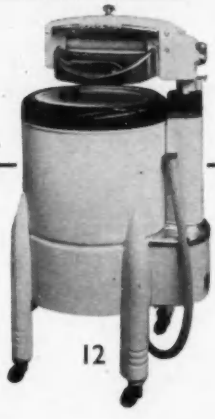

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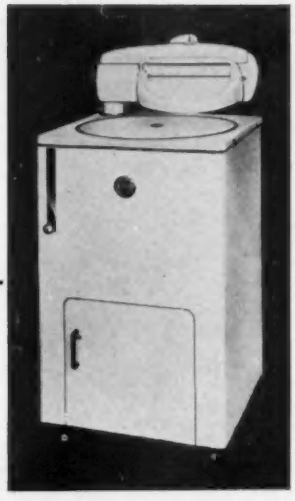

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Manufacturer or Distributor	Name or Model	Type	Size (H.W. & D. in inches)	Tub Capacity (Dry Clothes)	Loading if Heated	Method of Operation	Type of Wringer	Pump
KENWELL ELECTRIC, LTD., Meanwood Works, Spotland Bridge, Rochdale.	" Kenwell "	Cabinet	32¾×22×22	7 lb	3 kW	Agitator	Power	Yes
LONGFORD ELECTRIC CO., LTD., 6, Grosvenor Street, Manchester, 1.	" Zetamatic "	Cabinet	34×22½×20½	6½ lb	2 kW	Plastic impeller	Spin dryer	Yes (two)
RADIATION, LTD., (Electrical Division), 255, North Circular Road, London, N.W.10.	" Parnall " EW51	Cabinet	36×20½×20½	6½/7 lb	—	Reciprocating Bakelite agitator	Power	Yes
	" Parnall " EW51H	Cabinet	36×20½×20½	6½/7 lb	3 kW	Reciprocating Bakelite agitator	Power	Yes
	Thor 260	Cabinet	36×25×25	8 lb	—	Reciprocating Bakelite agitator	Spin dryer	Yes
	Thor 260H	Cabinet	36×25×25	8 lb	3 kW	Reciprocating Bakelite agitator	Spin dryer	Yes
JOHN SENIOR & CO. (1954), LTD., Bridge Street, Wednesbury.	" Joy " Standard Senior	Cabinet	36×22×22	8½ lb	—	Reciprocating agitator	Power	Yes
	" Joy " " Heat-o-matic " Senior	Cabinet	32×22×22	8½ lb	3 kW	Reciprocating agitator	Power	Yes
	" Joy " " Heat-o-matic " Junior	Cabinet	31×18×18	5½ lb	3 kW	Reciprocating agitator	Power	Yes
	" Joy " Standard Junior	Cabinet	31×18×18	5½ lb	—	Reciprocating agitator	Power	Yes
	" Joy " Junior (pumpless)	Cabinet	31×18×18	5½ lb	—	Reciprocating agitator	Power	No
ROLLS RAZOR, LTD., Cricklewood Broadway, London, N.W.2	" Foamatic "	Round, portable	21¾×15¾×14½	3/4 lb	—	Externally agitated, flexible tub	Siphon	
W. & S. SUMMERSCALES, LTD., Keighley, Yorkshire.	" Fairy "	Cabinet	30×17×17	8 lb	3 kW	Rotary agitator	Hand	Gravity drainage hose
	" Scales " S.1	Cabinet	30×17×17	8 lb	—	Rotary agitator	Hand	Yes
	" Scales " S.2	Cabinet	30×17×17	8 lb	—	Rotary agitator, automatic timing device	Hand	Yes

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17. *Longford " Zetamatic " combined washing machine and spin dryer*
18. *Wilkins & Mitchell " Servis Powerglide " washing machine*
19. *Rolls Razor's " Foamatic " portable washing machine*
20. *John Senior & Co.'s " Joy " " Heat-o-matic " Senior washing machine*
21. *Hoover " Hoovermatic " combined washing machine and spin dryer*
22. *" Lavalux " combined washing machine and spin dryer (Welmec Corporation)*
23. *Kenwell non-heated washing machine*
24. *Parnall model EW.50 washing machine (Electrical Division of Radiation, Ltd.)*
25. *W. & S. Summerscales " Scales " model SH.4 washing machine*
26. *Vactric model B.5207 washing machine*

Exterior Finish	Tub Finish	Price (excl. tax)	Purchase Tax
Cream stoved enamel	Aluminium	£55 0 0 £46 0 0 (non-heated)	£12 7 6 £10 7 0 (non-heated)
White stoved enamel	Aluminium	£63 0 0	£12 11 5
Vitreous enamel top, stoved enamel body	Vitreous enamel	£46 5 9	£10 8 3
Vitreous enamel top, stoved enamel body	Vitreous enamel	£54 17 2	£12 6 10
Vitreous enamel top, stoved enamel body	Vitreous enamel	£68 15 10	£15 9 7
Vitreous enamel top, stoved enamel body	Vitreous enamel	£74 11 5	£16 15 7
Vitreous enamel top, stoved enamel body	Vitreous enamel	£50 10 0	£11 7 3
Vitreous enamel top, stoved enamel body	Vitreous enamel	£55 0 0	£12 7 6
Stove enamelled	Aluminium	£47 18 7	£10 15 8
Stove enamelled	Aluminium	£43 1 0	£9 13 9
Stove enamelled	Aluminium	£39 15 0	£8 18 10
White stove enamelled, red trim	Rubber	£22 7 9	£4 18 3
White cellulose	Vitreous enamel	£36 14 0 £31 6 6 (non-heated)	£7 8 7 £6 5 1 (non-heated)
White cellulose	Vitreous enamel	£36 0 7	£7 5 5
White cellulose	Vitreous enamel	£38 14 11	£7 17 4

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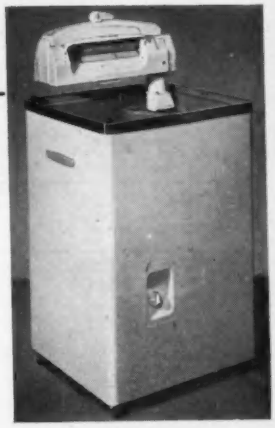

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Manufacturer or Distributor	Name or Model	Type	Size (H.W. & D. in inches)	Tub Capacity (Dry Clothes)	Loading if Heated	Method of Operation	Type of Wringer	Pump
W. & S. SUMMERSCALES, LTD., Keighley, Yorkshire. (*continued*)	"Scales" SH.3	Cabinet	30×17×17	8 lb	3 kW	Rotary agitator	Hand	Yes
	"Scales" SH.4	Cabinet	30×17×17	8 lb	3 kW	Rotary agitator, automatic timing device	Hand	Yes
VACTRIC, LTD., 207, Sloane Street, London, S.W.1.	"Vactric" B.5207	Cabinet	36×20×22	9 lb	3 kW	Rotary plastic agitator	Power	Yes
WILKINS & MITCHELL, LTD., The Green, Darlaston, South Staffs.	"Servis" De-Luxe	Cabinet	34½×22½×23½	9 lb	—	Gyrator	Power	Yes
	"Servis" Superheat	Cabinet	34½×22½×23½	9 lb	3 kW	Gyrator	Power	Yes
	"Servis" S	Cabinet	32×18×20	4½/6 lb	2·3 kW	Impeller	Hand	Yes
	"Servis Powerglide"	Cabinet	32½×19×20	4½/6 lb	2·3 kW	Impeller	Power	Yes
WELMEC CORPORATION, LTD., 147, Strand, London, W.C.2.	AEG Standard	Cabinet	31×17×19	4/5 lb	2 kW	Rotary pulsator	Hand	Yes
	AEG 3000	Cabinet	32×18×20	7/8 lb	2 kW	Rotary pulsator	Hand	Yes
	"Lavalux"	Cabinet	32½×32½×19½	5 lb	2 kW	Pulsator	Spin dryer	Yes
	Table top for "Lavalux," £2 14s plus 6s purchase tax (stove enamelled) or £3 12s 1d plus 7s 11d purchase tax ("Formica")							

NEW BOOKS

Conformal Transformations in Electrical Engineering. By W. J. Gibbs. Pp. 219; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 45s.

This is an important book for electrical engineers, since it deals with the application of the method of conformal transformations to practical electromagnetic problems arising from inverse square fields. The text, moreover, is not limited to transformations involving only elementary functions but includes those calling for the evaluation of elliptic functions. In fact, it is the discussion of the elliptic integrals and functions used in practical conformal mapping that is the most valuable feature of the book for engineers.

Before the publication of this book the only engineering text dealing with conformal mapping was Miles Walker's "Conjugate Functions for Engineers," and this, which is now out of print, was confined to examples needing only elementary functions for their solution; configurations involving more than two right-angles and elliptic functions were not considered. When a designer meets such configurations his first reaction is to avoid the elliptic functions by turning to his drawing board, or, if he has the time, setting up the problem on an analogue computer and interpreting the quantities measured. These devices, however, will not give him the same mathematical satisfaction as an analytical solution derived from the application of the Schwarz-Christoffel equations to his problem.

The various practical ways of obtaining satisfactory analytical solutions are described. In the earlier chapters Dr. Gibbs outlines the elements of field theory and deals with simple conformal transformations. He gradually increases the difficulty of the transformations until in the later chapters he discusses electric machine problems in terms of Theta functions and Jacobi's elliptic integrals of the third kind. Dr. Gibbs points out that many of the difficulties that face engineers when they first use elliptic functions are imaginary. Nevertheless, the solution of practical problems calls for a working knowledge of the theory of functions of a complex variable, the calculus of residues, contour integration, etc. The author avoids theoretical pitfalls by making extensive use of the mathematical results tabulated by Byrd and Friedman in their "Handbook of Elliptic Integrals for Engineers and Physicists." The book can be recommended to engineers. A student who studies it and works carefully through the examples should be in a good position to attack any field distribution problem that he meets.—H.J.J.

Kempe's Engineer's Year Book for 1959. Edited by C. E. Prockter under the direction of B. W. Pendred (editor-in-chief of the *Engineer*). Pp. 2,740; figs. Morgan Bros. (Publishers), Ltd., 28, Essex Street, Strand, London, W.C.2. Price for two volumes in case 82s 6d; postage 2s 6d extra.

In the 64th edition of this manual the chapters on flow-metering and mechanical testing, refrigeration, and paints and varnishes have been rewritten. Additions have been made to 24 chapters, including that on electrical engineer-

Exterior Finish	Tub Finish	Price (excl. tax)	Purchase Tax
White cellulose	Vitreous enamel	£41 9 3	£8 9 4
White cellulose	Vitreous enamel	£43 12 3	£8 18 10
White or cream stoved enamel	Pastel green glass fibre	£60 15 0	£11 14 0
White or cream or red, blue, green, yellow with white or cream	Vitreous enamel	£49 15 11	£11 4 1
White or cream or red, blue, green, yellow with white or cream	Vitreous enamel	£57 2 10 (table top 45s extra)	£12 17 2 (table top 5s 5d extra)
White or cream or red, blue, green, yellow with white or cream	Aluminium	£41 15 0 £44 4 0 (with timer)	£8 15 0 £9 6 0 (with timer)
White or cream or red, blue, green, yellow with white or cream	Aluminium	£48 11 5 £44 1 8 (non-heated)	£10 18 7 £9 18 4 (non-heated)
White stoved enamel	Stainless steel	£42 17 0	£8 17 0
White stoved enamel	Stainless steel	£48 12 0	£10 0 6
White stoved enamel	Copper spin dryer drum	£72 19 7	£16 0 3

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27. *AEG 3000 washing machine (Welmec Corporation)*

28. *Wilkins & Mitchell "Servis Superheat" washing machine*

ing in which details have been given of the electrical performance of rotating electrical plant. The chapter on mechanics now includes the fundamental formula dealing with the motion of missiles and satellites, and escape velocity. There are a number of new illustrations whilst the necessary alterations and additions have been made to the index which now has over 17,000 entries. Most chapters include a bibliography giving a list of standard works on the subjects dealt with.

Metal Rectifier Engineering. By E. A. Richards. Pp. 209, figs. Published by Sir Isaac Pitman & Sons, Ltd., Pitman House, Parker Street, Kingsway, London, W.C.2. Price 37s 6d.

The ground covered by this book is largely indicated by the author's position until recently of chief rectifier engineer to Standard Telephones & Cables. Thus it appears primarily to cover rectifiers of the selenium type, but with the subject matter expanded to include copper oxide and copper sulphide rectifiers completing the field of plate-type rectifiers, and with chapters also on germanium and silicon rectifiers to cover all types of "metal rectifier." The most interesting addition to the literature in book form on this subject is a section dealing with the principles and manufacturing processes of selenium rectifier plates. Undesirable characteristics such as deforming, creep and ageing are dealt with more frankly than in the sales literature on the subject.

The derivation of voltage and current relationships for various rectifier circuits—which forms the backbone of all books on this subject—is, of course, included. In this respect the book will be found particularly useful for such circuits as are generally confined to metal rectifier equipments, e.g. bridge circuits and single-phase circuits with capacitors. Smoothing circuits are also dealt with and the results obtained from their use are expressed in graphical and tabular form.

An unusual omission in the circuit theory is any reference to transformer reactance. Equipment cooling is dealt with but in an over-simplified manner as, for example, in the formula giving the heat dissipation from a tank to air as being proportional to the temperature rise. No bibliography is included.

"Metal Rectifier Engineering" is a practical book that will obviously be of interest to the user of metal rectifier equipments and have a function also in the library of the rectifier specialist.—F.T.B.

BOOKS RECEIVED

Water Power Engineering. By Rolt Hammond. Pp. 303; figs. Heywood & Co., Ltd., 9, Kingsway, London, W.C.2. Price 50s.

Railway Signalling Systems. By John R. Day and B. K. Cooper. Pp. 144; figs. Frederick Muller, Ltd., Ludgate House, 110, Fleet Street, London, E.C.4. Price 9s 6d.

Mathematics Applied to Electrical Engineering. By A. G. Warren. Pp. 464; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 70s.

Elektrokeramik. By Alfred Hecht. Pp. 269; figs. Springer-Verlag, Berlin, W.35. Price DM 41.40.

The Story of the Ionosphere. By J. A. Harrison. Pp. 103; figs. Hulton Educational Publications, Hulton House, 161-166, Fleet Street, London, E.C.4. Price 10s 6d.

Year Book of the Heating and Ventilating Industry. Pp. 422; figs. Technitrade Journals, Ltd., 8, Southampton Row, London, W.C.1. Price 10s 6d.

NEW ELECTRICAL EQUIPMENT

Electric Fire

The new "Glo-Vector" electric fire now being manufactured by GLODUC PRODUCTIONS, LTD., 97, South Road, Wimbledon, London, S.W.19, is contemporary in styling and serves not only as an electric fire but also as a form of decorative fire screen. A heavy gauge 1 kW rod type element is vertically fitted in its unpolished aluminium reflector, over which is placed a close meshed gold anodised shaped guard. The effect, when the fire is in use, is an overall glow. The larger back-plate has a tri-tone flecked enamel finish in grey, red or yellow and the whole is mounted on three ½in diameter stove enamelled legs fitted with rubber feet to ensure stability. A plastic knob at the top serves as a carrying handle.

The "Glo-Vector" is 25in high by 18in wide and models are available for all voltages between 200 and 250. It is provided with 6ft of 3-core flexible and the price is £3 2s, plus 13s purchase tax in the United Kingdom.

Photo-Electric Counter

A high speed counter which is capable of recording light interruptions or pulses down to one millisecond duration is now being produced by P.A.M., LTD., Merrow, Guildford, Surrey. Up to 2,000 counts per minute can be made on the 6 digit Perram counter which is fitted with a mechanical resetting lever. The instrument operates from standard a.c. mains or a 12 V battery which may be connected simultaneously if desired, ensuring continuous operation in the event of a mains failure.

The standard photo-cell and lamp will operate up to 8ft apart and the sensing heads can be placed 100 yd from the counter unit for applications where remote control is required. The photo transistors in the detecting head are most sensitive to red and infra-red light, reducing the possibility of interference by daylight or fluorescent lamps. A small photo-cell probe 1½in by ½in diameter can be supplied for use where only limited space is available. An improved version of the Perram pocket sized battery-operated portable transistorised counter is also announced, in which the counting rate has been increased to 1,200 per minute.

Miniature Sealed Relay

The type M miniature hermetically sealed relay announced by N.S.F., LTD., 31-32, Alfred Place, London, W.C.1, is suitable for operation in conditions of severe mechanical shock and working temperatures from −65 to +125 deg C. The relay, which is filled with an inert gas to prevent corrosion, has a balanced rotary type armature. A maximum of six change-over circuits can be switched. Originally designed to meet the requirements of United States Military Specifications MIL-R-5757B and MIL-R-25018, the relay is manufactured by N.S.F. under licence from the Westinghouse Brake & Signal Co., Ltd.

Silica-filled Chokes

A range of silica-filled control chokes for fluorescent lighting has been introduced by CAYSON ELECTRICS, LTD., 139, Queen's Road, Watford, Herts. The filling, which is of a non-drip thermosetting type, has good heat conductivity ensuring a low temperature rise and giving silent operation of the unit.

Encapsulated Mercury Relay

A waterproof mercury relay enclosed in a resin block, suitable for use in conditions where moisture or corrosive fumes are present at temperatures up to 70 deg C, has been introduced by ENGEL & GIBBS, LTD., Warwick Road, Boreham Wood, Hertfordshire. Although vertical mounting is preferable the relays will operate at inclinations up to 30 deg from the vertical.

Constructed from steel and ceramic, a combination capable of readily absorbing the heat generated from a momentary short circuit, the relay can withstand high current surges without damage. A section of the switch case is non-magnetic and the vertical plunger is drawn to this when the solenoid is energised. Contact is made by displacing mercury contained in the main body of the switch into a ceramic cup sealed into the upper end of the plunger, containing an auxiliary mercury pool into which a conducting electrode is dipped. The make and break is therefore between mercury pools. The relays are manufactured to B.S. 775, the contact being rated in accordance with Electrical Category A3.

The approximate weight is 9 oz and the overall dimensions of the relay are 3 $\frac{1}{16}$in high by 1 $\frac{31}{32}$in wide and 1 $\frac{31}{64}$in deep.

Totally Enclosed Motors

A range of totally enclosed motors to B.S. 2048 and N.E.M.A. Standard MG.1 has been introduced by NEWMAN INDUSTRIES, LTD., Yate, Bristol. Single-phase capacitor start motors from ¾ to 1½ h.p. and three-phase motors from 1 to 2 h.p. are available arranged for foot, flange, or foot and flange mounting, running at 1,500 r.p.m. when operating from a 50 c/s supply or 1,800 r.p.m. with a 60 c/s supply.

The motor body is constructed from heavy gauge sheet steel with two cast iron end brackets and a diecast aluminium fan and fan cover. The terminal box is incorporated in the drive end bracket, access being obtained through a cover plate, and screwed conduit entries are provided. A centrifugal switch with silver contacts is incorporated in the non-drive end bracket of single-phase motors, enclosed in a dustproof moulded case. Manual or automatically resetting thermal overload protection can be provided on single-phase motors.

Domestic Refrigerator

The first refrigerator to be produced under the Jackson trade name has been announced by the Electrical Division of RADIATION, LTD., 225, North Circular Road, London, N.W.10. It is the "Jackson 202," a 2 cu ft absorption type refrigerator with 3·4 sq ft of shelf area. The construction and finish of the cabinet are unusual in that the inner and outer case are moulded in one complete piece. The material used is "Astralon" plastic, a non-inflammable material claimed not to chip, rust or discolour with age.

The overall height of the refrigerator is 26⅞in (plus 1in for thermostat knob) and it measures 21½in wide by 22¾in deep (including handle). Two adjustable shelves are fitted, a large sized freezing compartment and, in the door recess, there is provision for bottles, eggs, butter, etc. The cabinet, inside and out, is finished in white and the plastic trims, base strips and thermostat knob are in grey. The ice tray is of gold anodised aluminium.

The "Jackson 202" is designed to stand on the floor on its runners, on a table, or it can be wall mounted. Alternatively, a stand, together with a heatproof table top, can be provided. The total weight of the refrigerator is 63 lb, the heater loading is 85 W and models are available for the 200/230 and 230/250 voltage ranges. The price, including purchase tax, is £39 18s. The stand and table top are extra at £2 12s 6d.

Electric Counter Resetting

The type 100 electromagnetic counter manufactured by COUNTING INSTRUMENTS, LTD., 5, Elstree Way, Boreham Wood, Hertfordshire, is now available with electrically operated resetting facilities, a solenoid being mounted at the rear of the case operating the resetting mechanism when momentarily energised. Coils for both counting and resetting can be supplied for operation from 24/48 V d.c., 110/115 V a.c. 50 or 60 c/s and 230/250 V a.c. 50 c/s.

Vacuum Cleaner

The Electrical Division of RADIATION, LTD., has produced the Parnall "Tenten" vacuum cleaner, an easily-

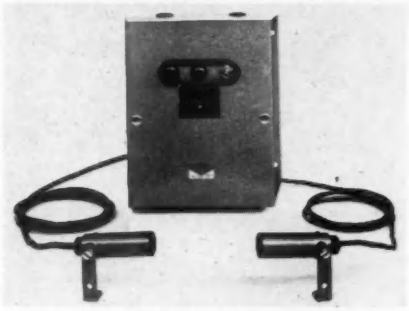
portable lightweight cleaner of unusual design. Shaped on the lines of a portable typewriter, it measures only 8¾in high by 13¼in wide by 20in in length. The casing consists of pressed steel upper and lower shells, stove enamelled inside and out, which contain a 500 W rubber mounted, double insulated motor, and the dust bag. One swivelled wheel is mounted in front of the machine and two fixed wheels at the rear.

Accessories include an 8ft steel reinforced plastic hose, three extension tubes, and nozzles and brushes, including a special attachment for deep cleaning. Known as the "Vibra-Beater," this carpet cleaning accessory has three rows of plastic beaters which vibrate at approximately 2,200 times a minute, assisting in the removal of deeply embedded dirt and grit.

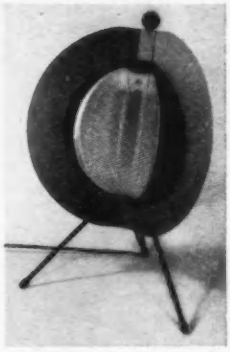
The "Tenten" cleaner is finished in green, cream and gold and normally operates in the horizontal position for room cleaning purposes. When in use on stairs it can be stood upright. The price, complete with all accessories, is £29 8s, including purchase tax.

Centrifugal Fans

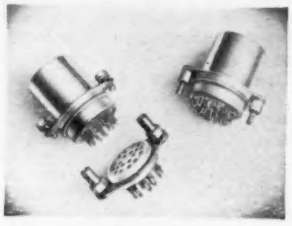
A range of high capacity centrifugal fans having a low sound level for heating, air conditioning and general ventilation applications has been introduced by KEITH BLACKMAN, LTD., Mill Mead Road, Tottenham, London, N.17. The initial range covers six sizes from 6 to 15in diameter handling volumes up to 9,000 c.f.m. at 3·5in w.g. Models arranged for direct motor drive or indirect drive are available, the indirectly driven fan incorporating a common bearing housing to ensure accurate alignment, and either sealed ball bearings or wick lubricated sleeve bearings can be supplied. External diffusers are not necessary with fans in the "Aristocrat" range as the use of a large throat and outlet area ensures low air velocity.



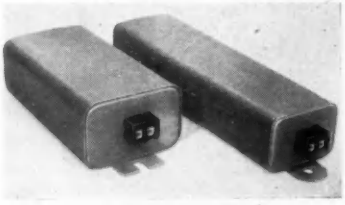
P.A.M. high speed counter



"Glo-Vector" contemporary styled electric fire

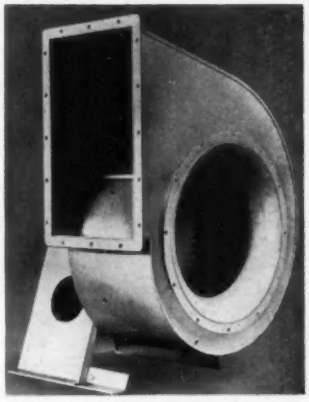


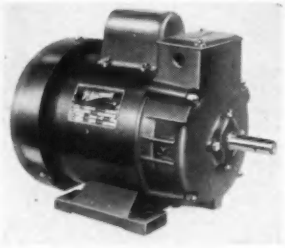
N.S.F. sealed relay



Cayson Electrics silica-filled chokes

Keith Blackman "Aristocrat" centrifugal fan

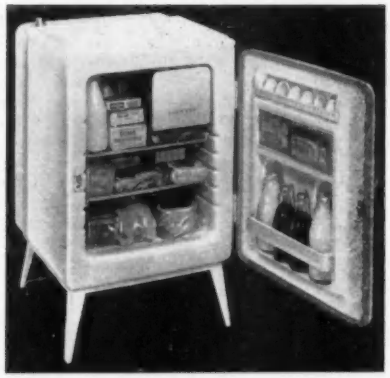




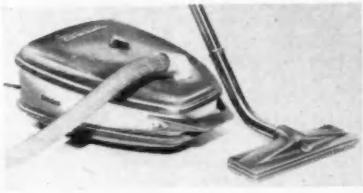
Newman totally enclosed motor

Engel & Gibbs mercury relay

"Jackson 202" 2 cu ft refrigerator



Parnall "Tenten" vacuum cleaner



Counting Instruments type 100 counter

Financial Section

STOCKS and SHARES

STARTING January with the average of leading industrial share prices at the highest level ever recorded, Stock Exchange markets became progressively quieter during the course of the month, while quotations showed an all-round inclination towards the easy side. Profit-taking does not appear to have materialised on any very substantial scale, but has continued to encounter nothing very effective in the way of opposition from new buyers. From the latter's point of view, considerations of the next General Election have clearly come to the top as a restraint on willingness to embark on fresh commitments. Gilt-edged stocks have been relatively firm.

Lower Prices

G.E.C. £1 shares remained under the influence of the reduction in the current year's interim dividend and lost a further 1s 6d to 32s 6d. C. A. Parsons and A. Reyrolle also lost ground again, but English Electric, at 58s 6d., regained 1s of the previous week's setback. Despite satisfaction with the earlier announcement of higher profits and the increase in the dividend, Decca went back about 2s 3d, the "A" shares being 35s ex-dividend. Westinghouse Brake, also ex-dividend, were dull at 40s, and Lancashire Dynamo at 42s 6d recorded a loss of 1s 3d for the second week running. Heavy engineering shares were still out of favour, the easier tendency being apparent in John Thompson, at 23s 9d, and Richardsons Westgarth, at 13s 9d.

Mixed Changes

Profit-taking made its presence felt in some of the domestic equipment shares, Hoover declining to 56s 6d (a loss of 1s 6d) and Morphy-Richards to 18s 9d. Fairly numerous reactions of minor dimensions affected, among others, Bowthorpe, Switchgear & Cowans, and Cable & Wireless. Vactric, however, made good headway against the general trend, with an improvement of 1s 9d to 30s, and Southern Areas again came in for support up to 14s 6d, having risen half-a-crown in a fortnight. Although still moving erratically, E.M.I. achieved a net recovery of 1s 6d to 54s, and Thorn Electrical moved up to 28s 3d after news of the agreements with Philco Corpn. of America. Tube Investments improved to 75s 6d, the new shares issued to former British Aluminium shareholders being about 1s higher.

British Vacuum Cleaner

There was a good response from British Vacuum Cleaner 5s shares to the company's declaration of an increase in the ordinary dividend from the equivalent of 5 to 7½ per cent; the official quotation was marked up from 4s 9d to 5s 3d, and shares changed hands in the market up to 5s 6d. At the time of the 100 per cent scrip issue in September, shareholders had been warned not to expect any advance on last year's distribution. They were also told of changes and new developments which, although unlikely to contribute much to this year's results, should substantially improve subse-

Price Changes in

Company or Board	Nom. Value	Middle price 2nd Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	79½		3	3	3 15 6	77	72
Brit. Elec. 1974/77	100	76½		3	3	3 18 6	73½	68½
Brit. Elec. 1976/79	100	79½		3½	3½	4 8 0	78½	72
Brit. Elec. 1974/79	100	89½		4½	4½	4 15 3	87½	82½
Overseas Electric Supply								
Calcutta Elec.	£1	17/-		6·8†	7†	14 6 6	17/6	15/-
East African Power	£1	21/6		7½	8	7 8 9	23/-	17/6
Nigerian Elec.	£1	15/-	+1/-	10	10	13 6 9	17/-	12/6
Perak Hydro-Elec.	£1	13/6		12½	10	14 16 3	15/6	13/6
Electrical Shares								
Aberdare Holdings	5/-	15/9		17½	17½	5 11 0	15/9	9/9
Aerialite	1/-	8/-		51½	54	6 15 0	8/6	5/1
Allen, W. H.	£1	43/9		10	11	5 0 6	43/9	32/9
Anglo-Portuguese Tel.	£1	28/3		8	9	6 7 6	29/3	19/9
Aron Elec. Ord.	£1	61/3		15	15	4 18 0	61/3	53/-
Assoc. Elec. Ord.	£1	55/-		15	15	5 9 0	58/9	46/6
Automatic Tel. & El.	£1	80/-		17	17	4 5 0	75/-	57/-
Babcock & Wilcox	£1	47/-		15	13‡	5 10 9	54/6	41/9
Bakelite	10/-	22/9		15	15	6 11 9	23/-	17/6
Baldwin, H. J.	2/-	2/6		20	20	—	3/9	2/6
Berry's Electric	5/-	11/-		10	10	4 11 0	11/3	5/9
Bowthorpe Holdings	2/-	12/-	−3d	37½	25*	4 3 4	11/9	6/6
British Elec. Traction: Def. Ord. "A"	5/-	37/-		25	25	3 7 6	40/-	19/6
B.I. Callender's	£1	46/9	−3d	12½	12½	5 7 0	52/-	38/9
B.I. Callender's 6% Pref. ...	£1	20/-		6	6	6 0 0	20/3	19/-
British Thermostat	5/-	37/6		25	30	4 0 0	36/3	19/9
British Vac. Cleaner	5/-	5/3	+6d	10	7½*	7 2 9	4/6	2/3
Brook Motors	10/-	50/-		25	24½*	4 16 9	45/-	27/9
Bulgin, A. F.	1/-	7/3		40	45	6 4 3	7/-	4/7
Bulpitts	5/-	10/6		—	12½‡	5 19 0	11/-	7/3
Burco Dean	5/-	12/6		22½	16*	6 8 0	12/6	7/9
Cable & Wireless: Ord.	5/-	13/-	−6d	10	10‡*	3 17 0	13/-	8/-
4% Loan	100	95	+1	4	4	4 4 3	94½	89
Chloride El. Storage "A" ...	£1	66/3		17½	17½	5 5 9	68/9	55/6
Clarke Chapman	£1	62/6		27½	27½	4 8 0*	72/6	55/-
Cole, E. K.	5/-	18/-		17½	17½	4 17 3	18/-	15/3
Cossor, A. C.	5/-	7/-	+3d	2½	Nil	Nil	7/9	4/4
Crabtree	10/-	29/-	−1/-	20	20	6 18 0	32/-	24/4
Crompton Parkinson	5/-	12/6		16	12*	4 16 0	13/9	8/3
Davis & Timmins	5/-	15/-		22½	18	6 0 0	16/3	10/3
De La Rue	10/-	32/6		35	17½*	5 7 9	34/-	20/9
Decca "A"	4/-	35/-x.d.	−2/3	43½	50	5 14 3	37/6	21/3
Desoutter	5/-	19/9		32½	18½*	4 15 0	19/3	13/6
Dewhurst	2/-	7/6		20	20	5 6 9	9/3	6/9
Dictograph Tel.	2/-	7/6		20	20	5 6 9	7/3	4/7
Dubilier Condenser	1/-	3/6		30	20*	5 14 3	4/3	3/1
Duport	5/-	10/3		25	12½*	6 2 0	10/9	7/9
E.M.I.	10/-	54/-	+1/6	15	20*‡	3 14 0	52/6	20/9
Electrical Components	5/-	10/9	+3d	12½	12½	5 16 3	10/9	7/-
Elec. Construction	£1	28/9		8½	8½	5 18 3	28/9	21/-
Elliott-Automation	5/-	17/6		—	10‡	2 17 3	19/9	11/6
Enfield Cable Ord.	£1	20/-		Nil	2½	2 10 0	18/9	10/9
English Electric	£1	58/6	+1/-	14	14	4 15 9	60/-	44/-
English Electric 3½% Pref. ...	£1	12/6		3½	3½	6 0 0	12/6	11/9
Ericsson Tel.	5/-	26/3	−6d	22†	12*‡	3 17 6	26/3	17/6
Ever Ready	5/-	23/6		37½	20*	4 5 0	22/3	13/9
Falk Stadelmann	£1	42/6	−1/3	17½	15	7 1 3	46/3	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

quent profits. For the year ended last September, the company reports a surplus of £48,500 (against £8,400 previously), after deduction of £30,000 under the heading of development expenditure. Leaving that item out of account, the new rate of dividend on the company's shares is covered practically three times over.

International Computers

British Tabulating Machine appears now under its new style of International Computers & Tabulators, following the conclusion of final details giving effect to the merger with Powers-Samas Accounting Machines. This was accomplished by B.T.M.'s acquisition from Vickers of the whole of Powers-Samas capital, and the subsequent issue to Vickers of 38 per cent of the ordinary capital of the combined undertaking, which musters net assets of over £23 million. Earlier announcements had said that accounts of the new I.C. & T. company would be made up to September of this year, and that profits were not expected to be under the combined balance of £893,000 (after tax) earned by the two companies last year. On that basis, the directors forecast a dividend of not less than 8 per cent, which would be equivalent to the rate last paid by B.T.M. Strength in the latter's shares has been a feature of the industrial market in recent months.

Electrical Investments

Company or Board	Nom. Value	Middle price 2nd Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Electrical Shares—continued								
G.E.C.	£1	32/6	−1/6	12½	10	6 3 0	40/-	29/3
G.E.C. 6½% Pref.	£1	21/-		6½	6½	6 3 9	21/6	20/3
General Cables	5/-	8/3	−6d	24	15	9 1 9	11/9	8/3
Greenwood & Batley	£1	80/6		17½	20	4 19 6	57/6	45/-
Hackbridge Holdings	5/-	14/9	−3d	20	20	6 15 6	15/3	7/6
Hackbridge & Hewittic	5/-	15/3		20	20	6 11 3	14/6	9/7
Head Wrightson	5/-	25/3		22½	17½*	3 9 3	26/-	16/9
Heatrae	2/-	8/9		15	20	4 11 6	7/9	4/-
Holophane	5/-	16/-		37½	22½*	7 0 9	15/6	12/6
Hoover	5/-	56/6	−1/6	50	50	4 8 6	58/6	31/-
I.C.I.	£1	34/-	−9d	10	12	4 14 3*	37/6	23/9
Intl. Combustion	5/-	31/3		22½	25	4 0 0	28/3	19/3
Intl. Computers & T.	£1	62/6		—	8‡	2 11 9	—	—
Johnson & Phillips	£1	25/9		10	5	3 17 9	25/-	15/-
Lancashire Dynamo	£1	42/6	−1/3	11	11	5 3 6	45/-	28/6
Laurence Scott	5/-	17/3		15	15	4 7 0	16/9	12/6
Lister, R. A.	£1	33/6	+6d	10	12½	7 9 3	34/6	23/-
London Elec. Wire	£1	70/-	−9d	12½	12½	—	72/-	39/6
Lucas, J.	£1	44/6		7½	10‡	4 10 0	45/-	27/9
Marconi Marine	£1	41/3		10	10	4 17 0	40/-	29/-
Marryat & Scott	2/-	9/-		35	37½	4 3 3*	8/9	5/3
Mather & Platt	£1	50/6		15	15	3 19 3*	50/6	29/6
Metal Industries	£1	43/9	+1/3	9	14	6 7 9	44/-	22/9
Midland Elec. Mfg.	£1	42/6		12½	10*‡	4 14 3	41/3	26/6
Morphy-Richards	4/-	18/9	−3d	20	20	4 5 3	20/-	14/6
Murex	£1	45/6	−1/6	20	17½	7 13 9	59/3	46/9
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/	2/6	−3d	17½	17½	7 0 0	3/-	2/3
Parsons, C. A.	£1	47/6	−2/6	8½	7½*	3 3 3	55/-	43/-
Plessey	10/-	72/6		30	30	4 2 9	72/6	55/-
Pye	5/-	14/-	−3d	12½	12½	4 9 3	17/-	10/-
Pyrotenax	5/-	35/-x.d.		—	27½‡	3 18 6	37/-	27/6
Reliance Clifton	5/-	18/3		13½	15	4 2 3	19/9	9/-
Reyrolle	£1	87/6	−2/6	17½	17½	4 0 0	93/9	73/6
Rheostatic	4/-	8/9		12½	12½	5 14 3	8/6	6/-
Richardsons Westgarth	10/-	13/9	−6d	16‡	8½*	6 1 3	15/9	13/-
Scottish Cables	4/-	14/3	+6d	27½	27½	4 9 6*	12/3	7/-
Simon-Carves	5/-	29/6	−6d	20	25	4 4 9	31/3	22/6
Smith (England), S.	4/-	11/9		20	12½*‡	4 5 0	12/3	7/-
Southern Areas	£1	14/6	+1/-	7½	Nil	Nil	13/9	9/3
Strand Elec.	5/-	8/3	−6d	15	15	9 1 9	9/3	4/9
Sturtevant	5/-	17/3		15†	15†	7 12 0	19/6	14/9
Sun Elec.	£1	66/3	+1/3	25	25	7 11 0	60/6	47/3
Switchgear & Cowans	5/-	10/6	−1/-	25	22½	5 7 3*	9/9	4/6
Taylor Tunnicliff	5/-	18/3		15	17½	4 16 0	18/3	11/9
T.C.C.	10/-	40/-		25	25	6 5 0	38/6	32/6
T.C. & M.	£1	34/-		8½	8½‡	—	37/-	20/-
Telephone Mfg.	5/-	5/3		10	10	9 10 6	5/9	4/3
Telephone Rentals	5/-	15/-	+3d	12½	12½	—	14/6	9/9
Thompson (John)	5/-	23/9	−9d	25	25	5 5 3	27/-	23/-
Thorn Elec.	5/-	28/3	+9d	17½	17½	3 2 0	25/-	17/-
Thornycroft	£1	21/9	−9d	12½	7½	6 18 0	30/9	21/-
Tube Investments	£1	75/6	+1/9	15	17½	4 12 9	81/3	48/3
Vactric	5/-	30/-	+1/9	25	25	4 3 3	—	—
Veritys	5/-	3/9		12½	2½	—	6/9	5/3
Walsall Conduits	4/-	17/3	−6d	20	22½	5 4 3	18/3	11/-
Ward & Goldstone	5/-	32/-x.c.		40	25*	3 18 3	37/-	23/6
Watford	2/-	7/9		25	25	5 3 3*	8/-	4/-
Westinghouse	£1	40/-x.d.	−1/6	10	10	5 0 0	45/-	32/3
West, Allen	5/-	12/-		15	12½*	4 17 3‡	13/3	7/9
Wolf Electric	5/-	8/3		20	10*	6 1 3	9/-	6/9

Cable Shares

Shareholders of London Electric Wire & Smiths now have in their hands the formal offer of the exchange into A.E.I. shares. In the former company's circular, which details the mutual advantages of the merger, the directors recommend members to accept the offer, as they have done themselves. In the case of another merger, tomorrow (Saturday) is the last day for Telegraph Construction & Maintenance shareholders to notify acceptance of the share-exchange offer by B.I.C.C. Market activity in some of the other cable manufacturers' shares has remained higher than normal. It has centred lately on the shares of Enfield Cables, and Enfield Rolling Mills; the latter advanced to 45s 6d, having changed hands at times up to 50s. Johnson & Phillips showed little further change at 25s 9d, while Scottish Cables rose 6d to 14s 3d.

Market Notes

Ward & Goldstone have given voting rights to the previously voteless "A" ordinary shares. Ordinary shareholders have received one new share, free, for every fifty by way of compensation. There is consequently now a single class of ordinary shares, quoted at 32s. R. B. Pullin 2s shares have been very firm, with transactions recorded up to 9s, since the announcement of a final dividend making a total of 20 per cent (as for the three previous years) for the twelve months ended in September, with the addition of a 5 per cent payment described (with reference no doubt to the change in profits tax) as a special interim on account of the current year. Group profits (before tax) improved by £35,000 to £272,000. On a 25 per cent distribution the yield works out at about 5¾ per cent.

Radar for Norwegian Navy

The Decca true motion radar TM 909 has been ordered in quantity by the Royal Norwegian Navy for a new class of motor torpedo-boats.

REPORTS and DIVIDENDS

General Cable Manufacturing Co., Ltd.—In his review of the period which accompanies the report and accounts for the year to 30th September last, Mr. C. W. R. Pantlin (chairman) says that the consolidated profit before taxation amounted to £116,686, as compared with £131,857 for the previous year. This was a far better result than was anticipated earlier in the year.

The keynote of the past year's trading has been steady and increasing competition in the rubber and plastic cable sections of the business. This has caused uneconomic selling prices which have had a considerable detrimental impact on profit margins. Moreover, conditions are still deteriorating at the present time, and the fact that the whole industry now faces major difficulties is clearly apparent from recent announcements of amalgamations and rationalisation schemes among the larger companies.

Current demands are far below the productive capacity of the industry, and that situation has persisted for a considerable time. In such circumstances price cutting on an increasing scale inevitably follows, but that is not a solution nor a practical and sensible approach to the problem unless the conditions have more claim to permanency than is evident at this stage. Electrical development and expansion throughout the world is forging ahead at an impressive rate and, in this country in particular, extensions and reinforcements of the distribution system which have been delayed for economic reasons must soon add their considerable quota to the demand for power cables.

Mr. Pantlin says that in his view these are facts that cannot be ignored and, consequently, the present situation should not be accepted as a sound and decisive guide to long-term prospects and policy for the cable industry. On the contrary, having regard to the immediate plans of electricity authorities in this country, it may well be that a significant recovery in demand is close at hand. It is therefore surprising that the major section of the industry has chosen this moment for offering reductions in power cable prices which are so considerable in extent and so selective in character as to indicate that trade politics, not manufacturing costs, constitute their real basis.

Inasmuch as this action clearly affects companies such as their own, which, for many years past, have performed a not inconsiderable service to the electricity authorities in helping to ensure supplies of cable at fair and reasonable prices, it is to be hoped that those authorities will view the present situation in broad perspective and, in their own long-term interests, treat with reserve any immediate and possible temporary benefits they may be able to secure by taking advantage of this latest movement.

In the meantime, trading conditions in the current year may be more difficult than their company has yet had to face, and it is advisable that it should conserve its resources; for this reason the board has felt it prudent to follow a cautious policy in regard to the dividend for the year under review.

Mr. Pantlin refers to the acquisition of 165,000 shares of the Britannic Cable Co. during the year, which makes that company a wholly-owned subsidiary of the General Cable Manufacturing Co.

Hilger & Watts, Ltd., report a group profit for the year ended 30th September last of £226,130, as compared with £181,062 for the preceding year. Taxation absorbs £113,376 and the net balance is £112,754 (against £87,690), of which £111,997 is attributable to the parent company. General reserve receives £50,000 and it is proposed to pay a final dividend of 8 per cent, making 13 per cent (unchanged) for the year. It is also proposed to pay a special interim dividend of 2 per cent for the current year, payable with the 1957-58 final dividend. The balance carried forward is £185,517 (against £155,743 brought in).

London Electric Wire Co. & Smiths, Ltd. — Particulars of the offer of Associated Electrical Industries, Ltd., for the whole of the company's issued share capital were given in our issue of 2nd January. These particulars and other relevant information are repeated in a circular sent to L.E.W. shareholders who are asked to notify their acceptance of the offer by 6th March.

The British Vacuum Cleaner & Engineering Co., Ltd., reports a group profit, before taxation, for the year to 30th September last of £127,672, as compared with £34,345 for the preceding year. Taxation absorbs £72,883 and the net balance is £48,515 (against £8,446), of which £48,311 is attributable to the parent company. It is proposed to pay an ordinary dividend for the year of 7½ per cent (against 10 per cent), on doubled capital.

W. H. Dorman & Co., Ltd., have completed negotiations for the acquisition of the whole of the share capital and undertaking of W. G. Bagnall, Ltd., Stafford, from the Heenan Group, Ltd.

English Electric Co., Ltd.—Lazard Brothers & Co., Ltd., announce that out of the issue of 1,826,606 ordinary shares 98½ per cent of the shares provisionally allotted to stockholders were taken up. Approximately 33,000 excess shares were available for which over 20,000 applications, totalling nearly 3,000,000 shares, were received. Applications for nine shares and under will be accepted in full. Thereafter, acceptances will be by ballot, successful applicants receiving 10 shares each.

Radio & Television Trust, Ltd.—Mr. K. R. Cork (chairman) announces that he has been informed by Crompton Parkinson, Ltd., which already holds all the preference stock and £29,175 15s of the issued £56,250 ordinary stock of the company, that it proposes to make an offer of 3s per ordinary stock unit for their stock to all other ordinary stockholders. The formal offer was to be considered at a board meeting of the Trust on 2nd February.

New Companies

Saro-Nuclear Enterprises, Ltd.—Registered 27th January. Capital £10,000. To carry on research, development and production in the field of nuclear science, and to carry on the business of exporters, importers and manufacturers of and dealers in equipment, instruments, goods, chemicals and materials necessary or ancillary to the carrying on of such matters and business, etc. The first directors shall be three persons nominated by Saunders-Roe, Ltd., and two by Nuclear Enterprises (G.B.), Ltd. Regd. office: Osborne, East Cowes, I.W.

Elesco Domestic Maintenance, Ltd.—Registered 13th January. Capital £100. Electrical, mechanical, radio, television, telephone, lighting, heating, motor and general engineers, etc. Directors: C. L. Dearing and S. C. Pinner. Regd. office: Rear of 129, Woodlands Road, Ilford.

Coombe Electrical Co., Ltd.—Registered 14th January. Capital £500. Electricians, electrical contractors, etc. Directors: A. P. Blackwell, P. Bloom, D. C. Boyce and C. G. Minter. Regd. office: 267, Coombe Lane, S.W.20.

Lamrad, Ltd.—Registered 6th January. Capital £100. Manufacturers of and dealers in fluorescent tubes and fluorescent lighting equipment, etc. Directors: J. H. Wilkins and Pamela Shears. Regd. office: 69, Gloucester Place, W.1.

John Bridger, Ltd.—Registered 7th January. Capital £5,000. Radio and television engineers, sound acoustic engineers, electrical engineers and general electrical installation contractors, etc. Directors: J. R. D. Bridger and Mrs. Dora A. Bridger. Regd. office: 171, Glanmor Road, Swansea.

D. Wilson (Electrical), Ltd.—Registered 12th January. Capital £100. Electrical engineers and contractors, etc. Directors: D. Wilson and June A. Wilson. Regd. office: 78, Dean Street, W.1.

Reco Electronics, Ltd.—Registered 12th January. Capital £1,000. Repairers and reconditioners of cathode ray tubes and accessories; manufacturers of and dealers in radio, telephone and television apparatus, etc. Directors: R. Barber, J. Ward and R. Murtagh. Regd. office: 48, Atlantic Chambers, 7, Brazennose Street, Manchester, 2.

Electravia, Ltd.—Registered 9th January. Capital £1,000. Manufacturers of and dealers in radio, television and radar sets, etc. Directors: C. J. C. Dorrington and P. T. Clarke. Regd. office: 2, Guildford Street, Chertsey.

G. R. Woolgar (Neon), Ltd.—Registered 8th January. Capital £1,000. Manufacturers of and dealers in neon and other signs, etc. Directors: G. R. Woolgar and Audrey M. Woolgar. Regd. office: 87/9, Baker Street, W.1.

Inductoforce, Ltd.—Registered 8th January. Capital £100. Manufacturers of and dealers in motors, dynamos, armatures, etc. Directors: J. Dalgleish and P. L. Oliver. Regd. office: 39, Dover Street, W.1.

Tripletone Manufacturing Co., Ltd.—Registered 20th January. Capital £1,000. Electrical engineers and contractors, manufacturers of and dealers in telephone, telegraphic,

electric, magnetic, galvanic, radio and other apparatus, etc. Directors: M. S. Corke, D. D. Corke and A. G. B. Paice. Regd. office: 241a, The Broadway, S.W.19.

Liquidations

R. G. Dixon (Worthing), Ltd., radio and electrical engineers, 3, St. Peter's Place, Brighton.—Winding up voluntarily. Liquidator, Mr. V. R. Chennell, 3, St. Peter's Place, Brighton, appointed 17th January. Particulars of claims to the liquidator by 28th February. This notice is purely formal. All known creditors have been, or will be, paid in full.

Bradleys (Swinton), Ltd., lamp shade manufacturers and dealers in electrical equipment, 42, Kennedy Street, Manchester, 2.—Winding up voluntarily. Liquidator, S. D. Crawford, 44, King Street, Manchester, appointed 13th January.

Bankruptcy

H. Pointon, 33, Churchill Road, Cheadle, Staffs., electrician.—Receiving order made 16th January on a creditor's petition.

INDIA'S ELECTRICAL TRADE

IN 1957 the total value of electrical goods imported by India, the British electrical industry's largest market, was £43·8 million, compared with £33·2 million in 1956. Fifty per cent (£21·9 million) of the 1957 imports came from the United Kingdom, and the next largest supplier was West Germany with 19 per cent (£8·3 million). Imports from the United Kingdom showed an increase of £700,000 over the 1956 figure.

From Table 1 it can be seen that switchgear, transformers, motors, generators and wires and cables were the largest individual items, and that India is one of the countries where competition from Japan and Eastern European countries is being felt. India's electrical exports, shown in Table 2, consisted mainly of mass produced small items and domestic appliances and these were sent mainly to Malaya, Burma and Ceylon.

TABLE 1.—INDIA'S ELECTRICAL IMPORTS IN 1957

Product	Value (£000)
Fuses	65
Relays	36
Oil circuit-breakers above 660 V	376
United Kingdom	29
West Germany	7
Switzerland	26
Ditto, up to 660 V	570
United Kingdom	361
West Germany	9
Sweden	16
Switzerland	26
Italy	41
Czechoslovakia	54
Primary switchboards	657
United Kingdom	518
West Germany	29
Switzerland	38
Italy	39
United States	14
Motor starters, a.c., up to 660 V	593
United Kingdom	495
West Germany	23
Denmark	19
Switzerland	29
Ditto, above 660 V	46
United Kingdom	35
West Germany	4
Control gear, starters, a.c.	57
United Kingdom	51
Control gear, starters, d.c.	31
United Kingdom	14
West Germany	13
Switchfuse units	760
United Kingdom	713
Japan	12
Control and switchgear, n.e.s.	3,970
United Kingdom	2,130
Sweden	34
Denmark	39
West Germany	338
Switzerland	248
Italy	53
Czechoslovakia	17
Japan	14
Canada	77
United States	1,001
Ditto, parts	2,052
United Kingdom	1,308
West Germany	257
Canada	291
Fusegear	56
United Kingdom	52
Austria	3
Generators, a.c.	391
United Kingdom	239
West Germany	67
Canada	65
United States	9
Generators, d.c., for train lighting	632
United Kingdom	629
Generators, d.c., others	161
United Kingdom	19
Switzerland	132
Generator sets with steam drive	257
United Kingdom	72
West Germany	104
Switzerland	68
Canada	66
Ditto, with diesel or petrol engine drive	651
United Kingdom	282
West Germany	196
United States	12
Ditto, with other drives	445
United Kingdom	135
Italy	10
United States	280
Generator parts	922
United Kingdom	232
West Germany	276
Switzerland	145
United States	216
Squirrel cage motors, 3 to 20 h.p.	405
United Kingdom	256
West Germany	56
United States	18
Ditto, 21 to 100 h.p.	168
United Kingdom	98
West Germany	27
United States	28
Ditto, above 100 h.p.	236
United Kingdom	75
West Germany	35
United States	111
Slip-ring motors, below 50 h.p.	80
United Kingdom	57
Ditto, above 50 h.p.	530
United Kingdom	224
West Germany	112
Switzerland	57
United States	83
Single-phase f.h.p. motors	207
United Kingdom	117
Other a.c. motors	363
United Kingdom	59
West Germany	109
Switzerland	84
Italy	44
D.c. f.h.p. motors	38
United Kingdom	30
Other d.c. motors	926
United Kingdom	113
United States	565
Motors, n.e.s.	333
United Kingdom	100
West Germany	56
Switzerland	55
Italy	64
Power capacitors	225
United Kingdom	88
Mercury arc rectifiers	225
United Kingdom	135
United States	83
Transformers, voltage regulators, reactors and parts	3,987
United Kingdom	2,027
West Germany	624
Switzerland	227
Belgium	116
Italy	296
Sweden	155
United States	553
Canada	172
Batteries and accumulators	356
Bulbs, arc lamps and tubes	509
Radio receiving tubes	321
Radio receivers and parts	1,166
United Kingdom	581
West Germany	86
Holland	269
Radio receivers and parts—*continued*	
Japan	23
United States	28
Radio transmitting sets, tubes and parts	265
Radio telephone and telegraph apparatus, and parts	211
X-ray, and other tubes and valves, n.e.s.	263
Telegraph apparatus, and instruments, and parts	180
Telephone apparatus and parts	294
Cooking ranges, domestic	21
Flat irons	44
Hot plates and toasters	22
Ovens, domestic	24
Stoves, domestic	11
Other domestic electrical appliances and parts	99
Industrial furnaces	611
United Kingdom	281
West Germany	242
Switzerland	65
Welding equipment	639
United Kingdom	288
West Germany	144
Switzerland	47
Czechoslovakia	44
United States	68
Indicating instruments	115
Household meters	844
United Kingdom	261
West Germany	332
Switzerland	72
Italy	23
Belgium	15
Austria	24
Hungary	14
Czechoslovakia	63
Japan	21
Railway signalling apparatus	205
Watthour meters and other integrating instruments	143
X-ray equipment	272
United Kingdom	65
West Germany	107
Holland	31
United States	58
Ditto, parts	134
Vacuum cleaners	21
Washing machines	31
Air circulators	33
Portable blowers	43
Table fans	15
Portable hand tools	231
Lead-alloy sheathed cables for lighting	41
Paper insulated cable	3,751
United Kingdom	2,761
West Germany	668
Belgium	95
Plastic insulated cable	178
United Kingdom	95
West Germany	96
Rubber insulated cable	1,453
United Kingdom	851
West Germany	270
Italy	59
Varnish cambric insulated cable	195
United Kingdom	162
Cables and flex, n.e.s.	401
United Kingdom	289
West Germany	40
Holland	32
Telephone and telegraph cables	647
United Kingdom	430
Denmark	266
West Germany	101
Copper winding wire and strips	1,071
United Kingdom	544
West Germany	237
Insulators and bushings	500
Magnets	101
Switches	216
Resistance wire, other than bare	875
United Kingdom	411
West Germany	211
United States	103
Parts of electric machinery n.e.s.	1,836
United Kingdom	699
West Germany	208
Norway	170
Italy	429
United States	183
Electric locomotives	185
United Kingdom	18
West Germany	17
United States	150
Ditto, parts	1,113
United Kingdom	58
West Germany	34
Belgium	135
Japan	652

TABLE 2.—INDIA'S ELECTRICAL EXPORTS IN 1957

Product	Value (£000)
Generators, motors, convertors, transformers and switchgear	14
Batteries and accumulators	69
Bulbs, arc lamps and tubes	9
Radio, radar and TV apparatus	64
Apparatus, other than radio, for telegraphy and telephony	3
Heating apparatus including domestic	5
Electrical appliances for motor vehicles, aircraft, ships, cycles and i/c motors	3
Portable electric tools and domestic appliances	125
Ceiling fans	117
Burma	18
Kuwait	8
Ceylon	39
Singapore	18
Nigeria	2
Insulated cables and wires	4
Electrical machinery and apparatus, n.e.s.	20

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

14885. Henley's Telegraph Works Co., Ltd., W. T., and Griffiths, F. T.—Extrusion apparatus. 19th May, 1955. (808415.)

19227. Painton & Co., Ltd.—Electrical contact lubrication. 30th June, 1955. (808416.)

1955

2556. Sylvania Electric Products, Inc.—Methods of and apparatus for assembling electronic tube components or the like. 27th January, 1955. (808482.)

5176. Kelvin & Hughes, Ltd.—Ultrasonic testing of materials. 15th February, 1956. (808274.)

6327. Auto Diesels, Ltd.—Auxiliary electrical supply equipment. 31st May, 1956. (808275.)

10238. Philco Corporation.—Semiconductor devices and the manufacture thereof. 7th April, 1955. (808417.)

13945. General Electric Co., Ltd., and Judson, A. E.—Devices for mounting electrical components. 14th May, 1956. (808494.)

15403. British Thomson-Houston Co., Ltd.—Electric constant power circuits. 28th May, 1956. (808495.)

20734. Landis & Gyr A.G.—Three-phase four-wire induction meter. 18th July, 1955. (808499.)

21856. General Electric Co.—Electric control arrangements utilising semiconductor devices. 28th July, 1955. (808562.)

22022. Associated Electrical Industries, Ltd.—Nuclear reactors. 29th October, 1956. (808563.)

23509. National Research Development Corporation.—Digital encoders. 2nd August, 1956. (808564.)

24384. Sylvania Electric Products, Inc.—Electrical components embodying helical conductors. 24th August, 1955. (808282.)

24430. Automatic Telephone & Electric Co., Ltd.—Register-connectors for use in telephone systems. 7th August, 1956. (808375.)

24646. Dresden Filament Co., Ltd.—Electrically operable gas lighters. 26th November, 1956. (808503.)

30768. General Electric Co., Ltd.—Distant control systems. 24th October, 1956. (808567.)

31381. General Electric Co.—Locating systems for use with semiconductor devices. 2nd November, 1955. (808569.)

32411. Libbey-Owens-Ford Glass Co.—Production of transparent electrically conducting films and compositions therefor. 12th November, 1955. (808570.)

35616. Chicago Telephone Supply Corporation.—Combined housing and mounting for variable resistors and similar radio and television controls. 12th December, 1955. (808377.)

37122. Philips Electrical Industries, Ltd.—Devices for determining the relative deviation of the mean frequencies of pulse sources. 28th December, 1955. (808428.)

1956

4436. General Electric Co.—Crystal filters. 13th February, 1956. (808510.)

4453. Babcock & Wilcox, Ltd.—Nuclear reactor fuel element handling plant. 12th February, 1957. (808381.)

6421. United Kingdom Atomic Energy Authority.—Transistor circuits. 27th February, 1957. (Cognate application 1885, 18th January, 1957.) (808434.)

6641 Soc. Générale de Constructions Electriques et Mecaniques, Alsthom.—On-load electrical switching arrangements comprising transition impedances. 2nd March, 1956. (808575.)

7214. British Insulated Callender's Cables, Ltd.—Electric capacitors. 7th March, 1957. (808383.)

8628. Jackson Electric Stove Co., Ltd.—Indicator devices for electric switches. 19th March, 1957. (808576.)

9678. General Electric Co., Ltd.—On-load tap-changing arrangements for electric transformers. 25th March, 1957. (808515.)

10603. Corning Glass Works.—Electronic tube structure. 6th April, 1956. (808292.)

12470. Plessey Co., Ltd.—Magnetostrictive transducer elements. 12th April, 1957. (808387.)

12800. E.M.S. Electrical Products, Ltd.—Collector track system for electrical distribution. 11th April, 1957. (808517.)

16794. Powers - Samas Accounting Machines, Ltd. — Electronic computing machines. 26th April, 1957. (808440.)

18018. Du Pont de Nemours & Co., E. I.—Process of carrying out high temperature reactions by means of a continuous rotating electric arc and apparatus therefor. 11th June, 1956. (808442.)

20700. Standard Telephones & Cables, Ltd.—Gas generating plant including electrical precipitation equipment. 4th July, 1956. (808522.)

21011. Philips Electrical Industries, Ltd.—Hybrid transformer couplings. 6th July, 1956. (808390.)

21093. General Electric Co., Ltd.—Methods of securing metal and like tubes to other bodies. 8th July, 1957. (808524.)

22057. Specialties Development Corporation.—Electrical network for detecting a condition, such as fire or overheat due to various causes. 17th July, 1956. (808445.)

23305. Standard Telephones & Cables, Ltd.—Railway route-setting equipment. 27th July, 1956. (808529.)

23591. Marconi's Wireless Telegraph Co., Ltd.—Reducing hum in valve circuits. 2nd April, 1957. (808448.)

23857. Philips Electrical Industries, Ltd.—Transistor push-pull amplifiers. 2nd August, 1956. (808530.)

24419. General Electric Co., Ltd., Brandreth, R. D., and Garthwaite, F. N.—Electrical apparatus of the kind comprising a chassis carrying electrical components and mounted in a cabinet. 9th August, 1957. (808587.)

25344. Electric Storage Battery Co.—Electric battery grid pasting machine. 20th August, 1956. (808532.)

25567. Pye, Ltd.—Means for mounting and securing a cathode-ray tube in a television receiver cabinet. 21st August, 1957. (808449.)

26035. Soc. Emerjy.—Electrically driven pumps. 24th August, 1956. (808533.)

26806. Beddow, V. J.—Battery terminals. 14th August, 1957. (808450.)

29559. Philips Electrical Industries, Ltd.—Semiconductor devices. 27th September, 1956. (808451.)

30460. Collins Radio Co.—System for calibrating oscillators. 5th October, 1956. (808591.)

33303. British Insulated Callender's Cables, Ltd.—Manufacture of oil-filled electric cables. 30th October, 1957. (808328.)

33853. British Thomson-Houston Co., Ltd.—Cooling discharge devices. 6th November, 1957. (808537.)

34117. Standard Telephones & Cables, Ltd.—Carrier wave modulators and demodulators. 8th November, 1956. (808396.)

35880. Standard Telephones & Cables, Ltd.—Circuit arrangements for the transmission of signals in shaft winding systems, from and to the cage. 23rd November, 1956. (808541.)

1957

586. Albert, P. L. L.—Snap-action electric switches. 7th January, 1957. (808458.)

2870. Signal-Stat Corporation.—Snap-action electric switch having an indicator. 25th January, 1957. (808547.)

7077. Standard Telephones & Cables, Ltd.—Radio telegraph systems. 4th March, 1957. (808461.)

9004. Soc. Française des Isolants, E. L.—Electric lines. 19th March, 1957. (808307.)

10406. General Mills, Inc.—Electrical regulators. 29th March, 1957. (808550.)

10887. Contraves A.G.—Electric plug boards. 3rd April, 1957. (808601.)

11190. Standard Telephones & Cables, Ltd.—Fabricating of semiconductor signal translating devices. 5th April, 1957. (808463.)

12527. Westinghouse Air Brake Co.—High resistance semiconductor cells. 17th April, 1957. (808605.)

15373. National Cash Register Co.—Transistor driver circuit. 15th May, 1957. (808331.)

19803. S.I.T.I.—Electric furnaces. 24th June, 1957. (808407.)

24887. Philips Electrical Industries, Ltd.—Indicating means for tone control devices. 7th August, 1957. (808471.)

28495. Veeder-Root, Inc.—Electromagnetic pulse counters. 10th September, 1957. (808616.)

1958

31247 and 31542. Sylvania Electric Products, Inc.—Multiple-station mount machines and methods of and apparatus for assembling electronic tube components or the like. 27th January, 1955. (Divided out of 808482.) (808483/4.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 14th February:—

Pneustroke. No. 781,757. Class 7. Electric welding machines and parts. **Pneustroke.** No. 781,758. Class 9. Electric welding apparatus (not machines), and parts.—Burnley Aircraft Products, Ltd., Fulledge Works, Burnley.

Union Carbide. No. 769,218. Class 9. Electric dry cells, batteries, electrodes, anodes, connecting pins for electrodes and anodes, welding apparatus (not machines), carbons for electrical purposes (other than for lighting), etc.—Union Carbide Corporation, New York, U.S.A. Address for service, c/o Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.

Pathometer. No. 778,487. Class 9. Electronic measuring instruments for use in testing water and the sensitivity of antibiotics and in soil analysis; and electronic measuring instruments for laboratory use in diagnosing cancer and in counting blood cells.—H. F. G. Sheppard, 30-31, Queen Street, London, E.C.4.

Brylette. No. 782,308. Class 9. Electric batteries.—M. F. Pilley, Ltd., Brylite Works, Bond Street, Stirchley, Birmingham, 30.

Vicap. No. 782,700. Class 9. Capacitors (electric).—A. H. Hunt (Capacitors), Ltd., Bendon Valley, Garratt Lane, Wandsworth, London, S.W.18.

Bornmaster. No. B776,681. Class 11. Electric clothes drying apparatus.—E. F. Gisbourn, A. G. Gisbourn and A. C. Grubb, trading as Bourne Electrical Engineering Co., 563, Stratford Road, Sparkhill, Birmingham, 11.

Flamenco. No. 781,959. Class 11. Electric heating apparatus (not for surgical or curative purposes).—Midland Electric Manufacturing Co., Ltd., M.E.M. Works, Reddings Lane, Tyseley, Birmingham, 11.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 9th FEBRUARY

Birmingham.—College of Technology, 6 p.m. I.E.E. South Midland Supply and Utilisation Group. "Supply Voltage and Current Variations produced by a 60-ton 3-phase Electric Arc Furnace," by Dr. B. C. Robinson and A. I. Winder.

Bournemouth.—Grand Hotel, Firvale Road, 8 p.m. A.S.E.E. Bournemouth Branch. "Oil Today," by M. E. Davies.

Bristol.—Electricity House, 6 p.m. I.E.E. Western Centre. "The Design and Performance of the Gas Filled Cable System," by E. P. G. Thornton and D. H. Booth.

Dublin.—Gresham Hotel. I.E.E. Irish Branch. Annual dance.

Leeds.—Hotel Metropole, 7 p.m. Institution of Production Engineers, East and West Ridings Region. "The Design of Automatic Machine Tools for Electronic Control," by Dr. F. Koenigsberger.

London.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Dissemination and Assimilation of Technical Literature—A Growing Problem," opened by J. K. Webb.

Criterion Restaurant, Piccadilly, W.1, 6.45 for 7.30 p.m. Illuminating Engineering Society. Golden jubilee commemoration dinner. (Speeches being relayed to Centres.)

White Hall Hotel, Bloomsbury Square, W.C.1, 7.15 p.m. A.S.E.E. Central London Branch. "Time-controlled Telephones," by H. E. J. Butler.

Newcastle-upon-Tyne.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Centre and N.E. Branch of the Institution of Mechanical Engineers. "The Deltic Locomotive," by C. M. Cock.

Norwich.—Assembly House, 7.30 p.m. I.E.E. East Anglian Sub-Centre. "Operational Experience at Calder Hall," by K. L. Stretch.

Southampton.—Guildhall, 6.30 p.m. I.E.E. Southern Centre. Faraday Lecture on "Automation," by Dr. H. A. Thomas.

Wembley Park.—Century Hotel, Forty Avenue, 8.15 p.m. A.S.E.E. North West London Branch. "Stage Lighting," by F. E. Brown.

TUESDAY, 10th FEBRUARY

Belfast.—Queen's University, Stranmillis Road, 6.30 p.m. I.E.E. Northern Ireland Centre. "The Design of the 330 kV Transmission System for Rhodesia," by F. C. Winfield, T. W. Wilcox and G. Lyon.

Birmingham. — Engineering Centre, Stephenson Place, 6.30 p.m. Institution of Heating and Ventilating Engineers, Birmingham and District. "Air Conditioning at Home and Abroad," by R. Harrison.

Burton-on-Trent. — E.M.E.B. Service Centre, 6.30 p.m. I.E.E. East Midland Centre. "Construction of Castle Donington Power Station," by F. Flavell.

Cardiff.—Angel Hotel, 7.30 p.m. A.S.E.E. South Wales Branch. Talk on the National Inspection Council, by E. J. Sutton.

Lecture Theatre, G.E.C., 6.30 p.m. Institution of Heating and Ventilating Engineers, South Western Branch. "Experience with the Heat Pump in Great Britain," by Miss M. V. Griffith.

Coventry.—Technical College, 6.30 p.m. I.E.E. South Midland Radio and Measurement Group. "Eurovision," by J. T. Dickinson.

Doncaster.—Technical College Hall, 7 p.m. Institution of Production Engineers, East and West Ridings Region. "The Manufacture of Diesel-Electric Locomotives," by E. Littler.

Glasgow.—Royal College of Science and Technology, George Street, C.1, 7 p.m. I.E.E. South West Scotland Sub-Centre. "Pattern Recognition by means of Automatic Analogue Apparatus," by Dr. W. K. Taylor and "A System for the Automatic Recognition of Patterns," by Dr. R. L. Grimsdale, Dr. F. H. Sumner, Dr. C. J. Tunis and Dr. T. Kilburn.

Leeds.—C.E.G.B. Offices, 6.30 p.m. I.E.E. North Midland Centre and Education Discussion Circle. Discussion on "Co-operation between College and Industry on Industrial Training Schemes," opened by K. J. Martin.

London.—Café Royal, 7 for 7.30 p.m. I.E.E. Radio and Measurement Sections. Joint dinner dance.

Grosvenor House, Park Lane, W.1, 6.30 for 7 p.m. Electrical Contractors' Association. Annual dinner.

Connaught Rooms, 12.30 for 1 p.m. Electrical Industries Club. Luncheon. Guest speaker, Lt.-Gen. Sir John Glubb.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Utilisation Group. "Electrical Safety," by S. J. Emerson.

Central Library, St. Peter's Square, 6.30 p.m. Society of Instrument Technology, Manchester Section. "A Contractor's Approach to Instrumentation," by J. Sheraton.

Portsmouth.—Ministry of Labour and National Service, 7.30 p.m. A.S.E.E. Portsmouth and District Branch. "Relay and Automatic Control in Industry," by Dr. W. L. Stern.

Rotherham.—Y.E.B. Service Centre, 7 p.m. E.P.E.A. Sheffield Technical Group. "Atomic Power Stations," by G. P. Bugden.

Wakefield.—C.E.G.B., Wakefield "B" Power Station, Agbrigg, 7 p.m. I.E.E. North Midland Graduate and Student Section. Sheffield Exchange Paper. "Atomic Generation," by R. W. Allen.

York.—Georgian House, Blossom Street, 7.30 p.m. A.S.E.E. York Branch. "Insulating Varnishes."

TUESDAY, 10th FEBRUARY to THURSDAY, 12th FEBRUARY

Harrogate.—Royal Hall. National Power Farming Conference.

WEDNESDAY, 11th FEBRUARY

Birmingham.—James Watt Memorial Institute, 6.30 p.m. I.E.E. South Midland Graduate and Student Section. "High Voltage Testing," by M. V. Bradbury.

Engineering Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. "Mains Cable Accessories."

Bradford.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. "The Industrial Landscape or Scenery and History," by Dr. E. M. Sigsworth.

Eltham.—Eltham Green School, Queenscroft Road, 7.45 p.m. A.S.E.E. South East London Branch. "Motor Control Gear," by W. J. Johnson.

Glasgow.—39, Elmbank Crescent, 8 p.m. A.S.E.E. Glasgow Branch. "Servicing Auto Electrical Systems."

Lancaster.—North Western Electricity Board, North Road, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. "Some Aspects of Heat-Pump Operation with particular reference to the Shinfield Installation," by Miriam V. Griffith.

London.—Dorchester Hotel, W., 6.45 for 7.30 p.m. Institution of Heating and Ventilating Engineers. Annual dinner.

Manson House, Portland Place, W.1, 6 p.m. Society of Instrument Technology, London Meeting. "A Digital Instrumentation System for Use in the Testing of Jet Engines," by L. Airey.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Radio and Telecommunication Group. "Silicon Transistors—Their Manufacture and Field of Operation," by Dr. J. T. Kendall.

Northampton.—College of Technology. Northampton and District Electrical Association. "The Practical Use of Transistors," by Mr. Bettridge.

Oxford.—Southern Electricity Board, 37, George Street, 7 p.m. I.E.E. Oxford District. Meeting. "Recent Developments in Colour Television," by I. J. P. James.

Rugby.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Dielectric Materials—Trends and Prospects," by C. G. Garton.

Treforest.—Glamorgan College of Technology, 6.30 p.m. British Institution of Radio Engineers, South Wales Section. "Industrial Television," by E. A. Naef.

Wolverhampton. — Wolverhampton and Staffordshire College of Technology, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midlands Section. "Some Aspects of the Control of Nuclear Reactors," by Dr. L. W. J. Newman.

Worcester.—Victoria Technical Institute, 7.30 p.m. I.E.E. South Midland Centre. Malvern and District meeting. "Electrical Floor Warming," by J. W. Moule and W. M. Stevenson.

THURSDAY, 12th FEBRUARY

Dundee.—Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. "Stereosonic Recording and Reproducing System; A Two-Channel System for Domestic Tape Records," by H. A. M. Clark.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Utilisation Section. "Discrimination between H.R.C. Fuses," by E. Jacks.

Manchester.—North Western Electricity Board, Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "An Analytical Approach to Industrial Lighting," by W. Imrie-Smith.

Plymouth.—S.W.E.B., New George Street, 3 p.m. I.E.E. South Western Sub-Centre. "Nuclear Power Generation," by W. J. Prior.

Pophams Restaurant, Royal Parade, 7.15 p.m. I.E.E. South Western Sub-Centre. Annual dinner.

Swansea.—S.W.E.B., The Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Semi-Conductors and Their Application," by Professor W. Fishwick.

Wimbledon.—Wimbledon Hill Hotel. A.S.E.E. South West London Branch. Annual dinner.

FRIDAY, 13th FEBRUARY

Aberdeen.—Robert Gordon's Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Stereosonic Recording and Reproducing System; A Two-Channel System for Domestic Tape Records," by H. A. M. Clark.

London.—Savoy Place, W.C.2, 6 p.m. I.E.E. Education Discussion Circle. Discussion on "Some Reasons for Failure in the Part III Examination," opened by Professor M. G. Say.

Caxton Hall, Westminster, S.W.1, 6.30 p.m. E.P.E.A. Southern Meter Engineers' Technical Group. "Modern Trends in Electrical Instruments," by Dr. G. F. Tagg.

14, Rochester Row, S.W.1, 7 p.m. Junior Institution of Engineers. "Energy Demands in Britain and a Fuel Policy," by Dr. J. G. King.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers, Medical Electronics Group. "Some Instrumentation Problems in Medical Electronics with particular reference to Electromyography," by P. Styles.

SATURDAY, 14th FEBRUARY

London.—A.S.E.E. North West London Branch. Theatre outing.

Newcastle-upon-Tyne. — I.E.E. North Eastern Graduate and Student Section, 10 a.m. Visit to G.E.C. Osram Glassworks, Leamington.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Altrincham.—Corporation. 17th February. Street lighting equipment. (See this issue.)

Berkhamsted.—U.D.C. Firms wishing to have their names included in the Council's lists for tendering for electrical installations for the period of one year from 1st April next should apply by 23rd February to the surveyor, Civic Centre.

Canada.—City of Winnipeg. 11th February. Two 7,500/10,000 kVA step-down transformers. (E.S.B. 2212/59. Ten/36960.)* Three 69 kV oil circuit-breakers. (E.S.B. 2213/59. Ten/36952.)*

Ellesmere Port.—Corporation. 23rd February. Trunk road lighting equipment. (See this issue.)

Formosa.—Central Trust of China, Taipei. 20th February. Instrument transformers, watthour meters, voltammeters, etc. (E.S.B. 2124/59/I.C.A. Ten/37003.)* Power cable. (E.S.B. 2122/59/I.C.A. Ten/37004.)*

Italy.—Ministero Difesa, Esercito, Rome. 12th April. Equipment for power stations, including diesel alternator sets, transformers, control and switchboards, distribution boards, batteries, cables and fuel storage tanks. (GD/7130/58. Ten/37078.)*

Iran.—Ministry of Posts and Telegraphs, Teheran. 19th February. Telephone and telegraph channel open wire carrier system, terminals and repeaters. (E.S.B. 1254/59. Ten/36945.)*

Korea.—Government Office of Supply, Seoul. 12th February. Radio transmitters and parts. (E.S.B. 2536/59. Ten/37072.)*

Lanarkshire.—County Council. 19th February. Trunk road lighting equipment. (See this issue.)

London.—Indian Supply Mission. 12th March. 60 MVA transformers. 17th March. 33 kV switchgear. (See this issue.)

Luton.—Corporation. 26th February. Street lighting equipment.

Maesteg.—U.D.C. 21st February. Electrical fittings (form No. 24), for one year from 1st April next. L. W. Jones, surveyor, Council Offices.

Manchester.—Corporation. 25th February. Power control and indication cables for Davyhulme sewage works extensions. (See this issue.)

Newcastle-on-Tyne.—City Council. 28th February. Electrical installation in first instalment of St. Mary Magdalene Hospital. G. H. Gray & Partner, 8, Portland Terrace, Newcastle.

Norwich.—City Council. 14th February. Electric lamps and torch batteries for the year commencing 1st April next. H. C. Rowley, city engineer, City Hall.

Oxford.—City Council. 22nd February. Electrical goods for the Old People's Home, Horspath Road. Chief welfare officer, Greyfriars, Paradise Street.

Pakistan.—Government Department of Supply and Development, Chittagong. 10th February. 11 kV switchgear and ring main units and 400/250 V switchboard. (E.S.B. 2379/59. Ten/36992.)*

Sherborne.—U.D.C. 14th February. Public lighting lamps and gear for the year ending 31st March, 1960. Surveyor, The Manor House, Newland, Sherborne.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

South Africa.—Stores Department, South African Railways, Johannesburg. 18th February. 1,000 primary cells. (E.S.B. 2133/59. Ten/36930.)*

South West Africa.—Windhoek Municipality. 17th February. 400 V air break switchgear and accessories. (E.S.B. 2829/59. Ten/37104.)*

United States.—Bureau of Reclamation, Denver, Colorado. 24th February. Power circuit-breakers for Granite Falls substation. (E.S.B. 2417/59. Ten/36995.)* 115,000 h.p. hydraulic turbine for Hoover power plant. (E.S.B. 2181/59. Ten/36974.)*

Vietnam.—Vietnam Textile Co., Ltd., Saigon. 28th February. Control panels, transformers, l.v. switchgear, cable, steam generating unit and air conditioning system. (E.S.B. 2425/59/I.C.A. Ten/37039.)*

Wortley.—R.D.C. 27th February. Group "A" street lighting installation at Ecclesfield. A. Wikeley, surveyor, Council Offices, Grenoside, Sheffield.

Wrexham.—Borough Council. 16th February. Electrical installations in houses on the Bryn Offa and Dean Road sites, and supply of consumers' combined switch and fuse chambers and cabinets. (See this issue.)

ORDERS PLACED

Bradford.—Public Works Committee. Electrical work at 156 houses and flats on the Allerton estate (£4,626).—J. Carter & Sons (Bradford).

London.—L.C.C. Installation of electric water heaters at Wormholt and Old Oak Estates, Hammersmith (£13,454).—F. J. Baynes & Co., Ltd. Renewal and improvement of electrical installation at Comber Grove County Primary School, Peckham (£3,605).—A. G. Purdy & Sons, Ltd. Renewal and improvement of electrical installation at Melcombe County Primary School, Fulham (£5,100).—Johnson, Smith & Co., Ltd.

Poole.—Hospital Management Committee. Electrical services in first phase of Poole General Hospital, Poole (£17,160).—F. H. Wheeler.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aberdeen.—Municipal offices in Broad Street (£750,000); G. Keith, city architect, 11, Broad Street, Castlegate.

Acton.—Factory, Colville Road; Henderson Engineering, Ltd., 15, Enfield Road.

Bolton.—Training college for technical teachers (£153,175); P. S. Rennison, town clerk, Town Hall.

Bootle.—Works reconstruction; James Blackledge & Sons, Ltd., Derby Road Mills.

Bristol.—Extensions, Southmead Hospital (£300,000); B. Ivor Day & Dakin, architects, 9, Clare Street.

Secondary school, Hartcliffe; city architect.

Conway.—Secondary modern school; director of education, Education Offices, Caernarvon.

Cornwall.—County secondary school at Liskeard; E. T. Verger, clerk, County Hall, Truro.

Durham.—First stage of physics laboratory at Durham University (£80,000); J. Gerrard & Son, builders, Swinton, Manchester.

Hotel, Gilesgate, for Northumberland Hotels, Ltd.; M. C. Robson & Sons, architects, 245, Newgate Street, Bishop Auckland.

Eastbourne.—Works and offices, Hampden Park; Hotchkiss Engineers, Ltd., 33, Terminus Place.

Eastleigh.—Technical college; Brazier & Son, Ltd., builders, 303, Portswood Road, Southampton.

Esher.—Dwellings (55), Farm Road; F. H. Norris, Paddock View, Dorking Road, Great Bookham.

Fareham.—Extensions to Price's Grammar School; Thomas F. Ford & Partners, architects, 189, Victoria Street, London, S.W.1.

Hemel Hempstead.—Cinema; Harry W. Weedon & Partners, architects, 45, Calthorpe Road, Edgbaston, Birmingham.

Henley.—New science block, etc., at Henley Grammar School; J. Leathart, architect, Mount Lodge, Sunningdale, Ascot.

Hexham.—New Council Chamber for R.D.C. (£22,000); W. Dixon & Son, architects, 1, Collingwood Street, Newcastle-on-Tyne.

Irlam.—Works extensions; Petrochemicals, Ltd., Partington estate.

Letchworth.—Houses (160), Grange estate; H. Plinston, clerk, Council House, Letchworth, Herts.

Liverpool.—Third instalment of Gateacre Comprehensive Secondary School (£200,000); city engineer, Municipal Buildings, Dale Street, 2.

London.—Office block, 162/66, High Holborn; F. Boreham, Son & Wallace, architects, 4a, Bloomsbury Square, W.C.1.

Nuclear engineering laboratory, Queen Mary College, Mile End Road; Playne & Lacy, architects, 19, Queen Anne's Gate, S.W.1.

Manchester.—Showroom and office block, Princess Street; city architect.

Five-storey extension (£200,000); Lewis's, Ltd., City Centre.

Erection of St. Mary's Primary School, Newton Heath; city architect, P.O. Box 488, Town Hall.

Northolt.—Flats (111), Moat Farm Road; Tersons, Ltd., builders, 4, Dollis Park, N.3.

Norwich.—Seven-storey office block, Surrey Street; T. P. Bennett & Son, architects, 43, Bloomsbury Square, London, W.C.1.

Ramsgate.—Showrooms and offices; Kent Motor Transport Co., Ltd., Turner Street.

Rugby.—Houses (70), Bilton Hall estate; New Ideal Homesteads, Ltd., South Street, Epsom.

Salisbury.—Dwellings (128); city surveyor, Council House, Bourne Hill.

Sunderland.—Additions to Roker Hotel, including 23 new bedrooms; E. M. Lawson, architect, Barras Buildings, Barras Bridge, Newcastle-on-Tyne.

Health centre, Hylton Castle estate (£25,000); borough architect, Grange House, Stockton Road.

New factory; Steel & Co., engineers, Crown Works.

Thorne.—Houses (116); clerk, Council Offices, Thorne, Doncaster.

Totteridge.—Church; Hammond & Miles, Ltd., builders, Scrafton Road Works, Ilford.

Trowbridge.—Houses (81); clerk to U.D.C., Town Hall.

West Bromwich.—Houses (180), on three sites; W. H. Greenwood, borough engineer, Town Hall.

Whitehaven.—Works extensions for West Cumberland Silk Mills, Ltd.; Border Engineering Contractors, Ltd., Queen Street.

Worcester.—Extension for Christopher Whitehead School for Boys; Musman & Cousens, architects, 12, Upper Berkeley Street, London, W.1.